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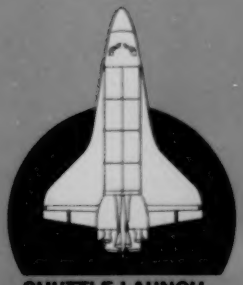

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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also Astronautics.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

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Includes passenger and cargo air transport operations; and aircraft accidents.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2649

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2651

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2651

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 2660

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 2661

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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Includes powered and free-flight trajectories; and orbit and launching dynamics.

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For related information see also *09 Research and Support Facilities (Air)*.

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19 SPACECRAFT INSTRUMENTATION **N.A.**

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20 SPACECRAFT PROPULSION AND POWER **2668**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) **N.A.**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **2668**

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **2671**

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS **2676**

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

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28 PROPELLANTS AND FUELS **2680**

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) **2683**

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **2685**

Includes land and global communications; communications theory; and optical communications.

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Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

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38 QUALITY ASSURANCE AND RELIABILITY **2715**

Includes product sampling procedures and techniques; and quality control.

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Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

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Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2781
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2781
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2782
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2783
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2783
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2784
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2786
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2787
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2788
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2789
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2789

Note: N.A. means that no abstracts were assigned to this category for this issue.

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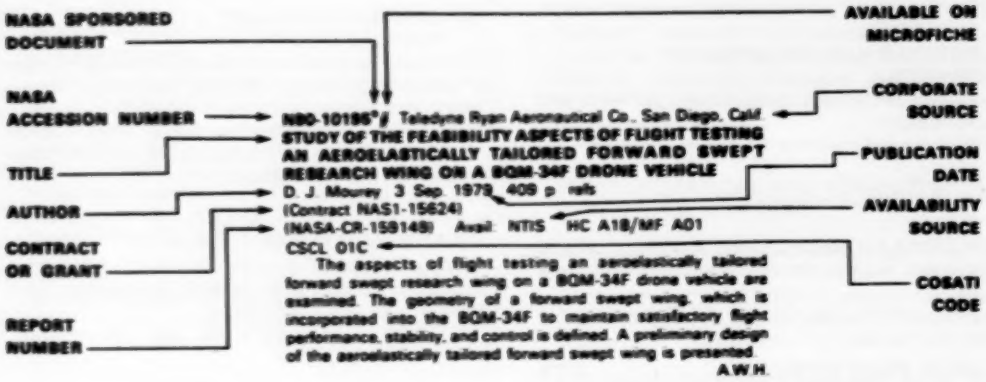
TYPICAL CITATION AND ABSTRACT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N80-10186*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
PUBLICATION DATE
AUTHOR
D. J. Mourey 3 Sep. 1979 409 p refs
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AN EXPERIMENTAL INVESTIGATION OF THE BEHAVIOR OF SUB-GRID SCALE MOTIONS IN TURBULENT SHEAR FLOW

B.J. Cantwell, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 2-21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, RESEARCH AND TRAINING IN COMPUTATIONAL TURBULENCE FLOW SIMULATION

W.C. Reynolds, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NAG 2-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0003, A STUDY OF METHODS FOR IMPROVING CAPACITY AT MAJOR AIRPORTS

A. Kanafani, University of California, Berkeley Campus, School of Engineering, Dept. of Civil Engineering, *Berkeley, California* 94720 (NAG 2-19)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, GAS MIXTURE REACTIONS

D. Kley, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (BDJ42787)

PROJECT OBJECTIVE: Design, construct and test various instruments to measure critical reaction and photodissociation rates in the atmosphere by means of reactions of sunlight on gas mixtures.

CURRENT YEAR PLAN: Complete design and construction of instruments: a) to detect H2O in the stratosphere, b) to measure O2 photodissociation, and c) to measure O3 photodissociation. Fly balloons with instruments a) and b). Heavy machine shop use anticipated.

PROGRESS REPORT: Laboratory tests on instruments a) and b) were performed and found satisfactory enough to justify building of flight instruments.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Systems Research & Development Service

1.0005, EFFECT OF EXTERNAL FLOW IN EXISTING TURBULENCE

M.S. Uberoi, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Aerospace Engineering Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NAG 1-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0006, MEAN VELOCITIES AND REYNOLDS STRESSES IN A JUNCTURE FLOW

H.M. McMahon, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NAG 1-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0007, LOAD TRANSFER SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS

E.J. Barenberg, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Civil Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DOT-FH-11-8474 (MOD #4))

Longitudinal construction joints in rigid pavements is a major source of maintenance activity. Construction of longitudinal joints with load transfer systems using slip form pavers is a difficult construction operation which leads to a lowering in the overall quality of pavement construction. The purpose of this study is to design and validate alternate load transfer systems which can be constructed using slip form pavers without the usual construction problems. Alternate joint systems are being tested under field and laboratory conditions to determine which joint load transfer systems are most cost-effective.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, SENSOR FAILURE DETECTION AND CONTROL SYSTEM ACCOMMODATION

G.G. Leininger, Purdue University, School of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NAG 3-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0009, A STUDY OF METHOD TO PREDICT AND MEASURE THE TRANSMISSION OF SOUND THROUGH THE WALLS OF LIGHT AIRCRAFT

M.J. Crocker, Purdue University, School of Mechanical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 1-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, LOW-SPEED, HIGH-LIFT AERODYNAMICS

W.D. James, Iowa State University of Science & Technology, School of Engineering, Dept. of Aerospace Engineering, *496 Town Engineering Bldg., Ames, Iowa* 50011 (NAG 2-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0011, AERODYNAMIC STALL ALLEVIATION RESEARCH
R.W. Vanguent, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (NAG 1-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, ANALYSIS OF TRANSONIC FLOW PAST HELICOPTER ROTORS
D.A. Caughey, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, Dept. of Mechanical & Aerospace Engineering, *Ithaca, New York* 14850 (NAG 2-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0013, SUBSONIC WING/FUSELAGE AERODYNAMIC STUDY
G.M. Gregorek, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautics & Astronautics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 2-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0014, COORDINATION AND CONTROL OF MULTIPLE-ARMED MANIPULATION SYSTEMS
C.A. Klein, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 1-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, STUDY OF ALTITUDE TRANSITION IN AIRCRAFT ENERGY CLIMBS
H.J. Kelly, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (NAG 1-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0016, SPACE SHUTTLE WINDWARD SIDE VISCOUS FLOWFIELD PREDICTIONS
C.H. Lewis, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (NAG 1-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SOLAR POWER SATELLITE FLEXIBLE SYSTEM CONTROL ASSESSMENT - ANALYSIS
M.J. Balas, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engineering Aeronautic Engin & Mechanics, *110 8th St., Troy, New York* 12181 (NAS 9-16053)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STUDY OF PERMEABILITY OF POLYMERIC MATERIALS TO CONDENSABLE GASES AND ORGANIC LIQUIDS
I.G. Dillon, Tuskegee Inst., School of Arts & Sciences, Dept. of Chemistry, *Tuskegee Institute, Alabama* 36088 (NAG10-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

3.0002, ATMOSPHERIC CHEMISTRY OF HYDRAZINES
J.N. Pitts, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Chemistry, *Riverside, California* 92502 (DF336510; F08635-78-C-0307)

To investigate the gas phase reactions of selected hydrazines in the polluted and natural troposphere, including kinetic and mechanistic studies. The research is being conducted in support of the environmental quality assessment function of the Air Force. This function is currently deficient with regard to necessary detailed kinetic knowledge of the atmospheric reactions of hydrazine based fuels. This work will provide data essential to an accurate assessment of the environmental fate of these fuels in support of the space transportation system and F-16 for mission accomplishment and readiness.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0003, THE INTERACTION OF ELECTRONS WITH ATOMS AND MOLECULES - FUNDAMENTAL THEORIES AND PROCESSES
H.S. Taylor, University of Southern California, School of Letters Arts & Sciences, Dept. of Chemistry, *3551 University Ave., Los Angeles, California* 90007 (CHE79-10583)

This grant supports research under the Quantum Chemistry Program for theoretical investigations of scattering and energy transfer processes. Three principal areas will be pursued. All of them are concerned with electrons leaving, scattering from, or binding to atoms and molecules. One area is the further application of that form of many body theory developed by Professor Taylor to inelastic excitation and ionization of atoms and molecules by electron impact. Because of a recent and successful application of this theory to elastic electron-helium atom scattering over wide ranges of energy and angle, it is possible to extend the inelastic electron-helium work to higher accuracy. Another area is the interpretation of experiments in which electrons are scattered from atoms and molecules. In particular, new mechanisms will be explored for electronic-vibrational energy transfer. The last area deals with complex coordinate methods as applied to short-lived resonant atomic and molecular systems, to photoionization, and to electron scattering. New theoretical methods will be developed and tested first on model problems and then on atomic and molecular systems.

This is a renewal of research currently supported by NSF grant CHE7910583 to the University of Southern California.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, CHARACTERIZATION OF METAL AGGREGATES
J.L. Gole, Georgia Inst. of Technology, School of Chemistry, *225 North Ave. N.W., Atlanta, Georgia* 30332 (CHE79-09075)

This research is in the area of quantum chemistry. Small metal aggregates Mn, specifically Nan, Sbn, Cun, and Agn, where n varies from 2 to 4, will be studied using laser fluorescent techniques. The modes of characterization will include excitation and photoluminescence spectroscopy as well as laser induced atomic fluorescence. The vibrational and rotational structure of bound states will be analyzed. Photoionization will be used to determine the behavior of ionization potential with cluster size for species of mass less than 400 amu. Experimental

studies will be supplemented with quantum chemical calculation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0005, OXIDE SURFACES OF TITANIUM ADHERENDS

J. Venables, Martin Marietta Corp., Martin Marietta Laboratories, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN890172; N00019-79-C-0294)

Investigate the oxides on titanium adherends prepared by various techniques for the purpose of providing understanding, guidelines and recommendations for pretreating titanium.

Investigate the morphology, crystal structure, chemical composition and failure mechanisms of oxides formed on titanium using surface sensitive techniques such as scanning transmission electron microscopy (STEM) and Auger-ESCA (electron spectroscopy for chemical analysis).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0006, DUCTILITY OF POLYCRYSTALLINE NICKEL ALUMINUM

E.M. Schulson, Dartmouth College, Thayer School of Engineering, Dept. of Materials Science, *P.O. Box 833, Hanover, New Hampshire* 03755 (NAG 3-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0007, LASER MASS SPECTROMETRY - VIBRONIC/ MASS SPECTROSCOPY VIA MULTIPLE PHOTON IONIZATION OF POLYATOMIC MOLECULES

R.B. Bernstein, Columbia University, Undergraduate School, Dept. of Chemistry, *Broadway & W. 116th St., New York, New York* 10027 (CHE78-25187)

This research is in the area of Quantum Chemistry; it involves molecular beam techniques. Dr. Bernstein plans to design and construct a laser mass spectrometer (LAMS) to make possible fundamental studies of vibronic/mass spectroscopy via multiple photon ionization (MPI). The LAMS technique combines the specificity of MPI vibronic spectroscopy with the generality of the mass spectrometric method. The new instrument will be used to investigate the basic process of multiple photon excitation, ionization, and, most important, fragmentation of polyatomic molecules. Several series of prototype molecules with different, archetypical electronic structures are to be investigated. The goal is to gain a detailed understanding of the mechanism of the stepwise absorption of visible (and UV) photons by polyatomic molecules, which lead ultimately to ionization and dissociation into charged and neutral fragments. The ionization-fragmentation NPI pattern also provides important information necessary for the unambiguous interpretation of 'conventional' ion current NPI spectra, as obtained in gas cells. The laser mass spectrometer (LAMS) can be used as a research instrument (i.e., to measure vibronic energy levels and investigate the electronic structures of excited states of molecules and radicals) as well as an analytical tool (i.e., for the identification of chemical compounds, analysis of mixtures and isotopic assay). Numerous applications of LAMS to basic chemistry are to be explored.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, EVALUATION OF REDUCED POLLUTION CORROSION PROTECTION SYSTEMS

C.J. Staebler, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (R80331-01; B610B-145)

OBJECTIVE: To evaluate reduced pollution corrosion protection systems as viable alternatives to presently used higher polluting systems.

APPROACH: Parameters for applying reduced-pollution coatings on typical aerospace and metal finishing industry substrates will be optimized. The coating systems will be comprehensively evaluated to establish confidence procedures, processing requirements coating life, and operating costs of selected coating systems will also be determined.

PROGRESS: Results obtained so far indicate there is considerable potential for replacing such high polluting systems as organic solvent paints, cyanide cadmium and copper plating, and hexavalent chromium plating with less polluting systems as well as testing of new systems such as water-reduced paints, powder coatings, strippable coatings and maskants, paint strippers and metallic coatings.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

3.0009, INFLUENCE OF COBALT ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF MAR M-247

R.D. Maier, Case Western Reserve University, School of Engineering, Dept. of Metallurgy & Materials Science, *University Cir., Cleveland, Ohio* 44106 (NAG 3-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0010, CONSTITUTIVE EQUATIONS FOR ANALYSIS AND DESIGN OF TURBINE ENGINE HOT SECTION COMPONENTS

A. Mendelson, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, MICROSTRUCTURE AND FATIGUE BEHAVIOR OF RHEOCAST IN-100

D. Apelian, Drexel University, School of Engineering, Dept. of Metallurgical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAG 3-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0012, OXIDATION OF LIQUID LUBRICANTS AND ITS RELATIONSHIP TO CHEMICAL CHANGES DURING ELASTOHYDRODYNAMIC AND BOUNDARY LUBRICATION

E.E. Klaus, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Chemical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NAG 3-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0013, LABORATORY KINETIC STUDIES OF ATMOSPHERIC REACTIONS

J.P. Heicklen, Pennsylvania State University, University Park Campus, School of Science, Dept. of Chemistry, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (ATM79-09169)

Laboratory data on the rates and mechanisms of chemical reactions are key inputs into models of troposphere and stratosphere. The objective of this research is to obtain data on three important classes of reactions: (1) formation and decay kinetics of CX2ClO2NO2 (X equals H, F, Cl, Br); (2) reactions of peroxy radicals with NOx and SO2; and (3) photolysis of aldehydes. The first of these reactions may be important as a temporary sink for Cl in the stratosphere, and the second and third are important chemical processes in the troposphere. Flash photolysis and kinetic spectroscopy techniques will be used in the experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0014, CONSTITUTIVE MODELS FOR CYCLIC PLASTICITY AND CREEP BEHAVIOR OF SUPERALLOYS AT HIGH TEMPERATURE
W.E. Haisler, Texas A & M University, College Station Campus, School of Engineering, Dept. of Aerospace Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAG 3-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0015, CARBON-13 NMR ANALYSIS OF SHALE OILS AND SHALE OIL DERIVED JET FUELS
W.O. Urnenbuch, Utah Higher Education System, University of Utah, School of Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAG 3-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, CONCEPTUAL DESIGN OF SCUBBING SYSTEMS FOR ROCKET MOTORS
S. Calvert, Air Pollution Technology Inc., *4901 Morena Blvd., Suite 402, San Diego, California* 92117 (68-02-2145; F617X-783250)

OBJECTIVE: Conduct an engineering study and design of methods for scrubbing the exhaust of static-tested solid rockets, particularly of hydrogen chloride and hydrogen fluoride gases, and prepare cost analyses for application to rockets with thrusts between 20 KW and 2 MN.

APPROACH: Provide comprehensive design criteria for scrubbing systems for controlling emissions from test firing rocket motors.

PROGRESS: EPA#EPA-600/7-78-057 NTIS#PB282-255/AS Design Criteria for Rocket Exhaust Scrubbers. Harry F. Bacharika, & Seymour Calvert, Mar 78. Report gives results of an engineering study & design of methods for scrubbing the exhaust of static-tested solid rockets. The best process for removing gas was found to be a gas atomized spray scrubber, using the power supplied by the rocket to atomize the scrubbing liquid.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

4.0002, REMOTE CONTROL HOVERCRAFT/VEHICLES TO PLUG/VIEW HAZARDOUS LEAKS
P.E. Wolven, Oxnard City Government, *206 W. 2nd St., Oxnard, California* 93030 (R805365; B610B-00212)

OBJECTIVE: Design, develop, demonstrate remotely controlled airborne vehicle or hovercraft (not helicopter) type to provide TV view of hazardous situations and, possibly, plug leaks, turn valves, etc.

APPROACH: Review state of art, assess power requirements, airborne time period definition, assemble and test prototype (Phase I), evaluate, construct and demonstrate engineering model.

PROGRESS: Prototype completed, testing underway.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

4.0003, DENSITY MEASUREMENT IN AIR WITH A SATURABLE ABSORBING SEED GAS
D. Bagunoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 2-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0004, DEVELOPMENT OF MODELS FOR NONLINEAR FRACTURE PROCESSES
F.W. Smith, Colorado State University, School of Engineering, Dept. of Mechanical Engineering, *Fort Collins, Colorado* 80523 (NAG 3-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0005, CLOUD PREDICTION AND RADIATION MODIFICATION EFFECTS OF POLLUTANTS FROM ENERGY PRODUCTION
R.F. Pueschel, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (D9-E693-EG; W833 -0037)

OBJECTIVE: Determine the chemical and physical characteristics of power plant plumes which lead to regional visibility and air quality (SO2 and fine particulates) deterioration over the long term; determine and verify long-range transport trajectories.

APPROACH: Conduct aircraft measurements of fine particulate aerosols from various power plants and groups of power plants, and assist in mapping pollutants concentrations (SO2 and fine particulates) due to various power plants and sets of power plants.

PROGRESS: The following points have been demonstrated from the evaluation of three field projects: (a) found no instance where the horizontal profile of particles and gases follow Gaussian distributions; (b) the horizontal profile extent of the plume is much in excess of that predicted by plume dispersion models; (c) fine particles are generated at rates of 10 to the fifteenth power to 10 to the seventeenth power per second; (d) the power plant plumes are guided to a degree by the topography of the underlying terrain.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Office of Environmental Processes & Effects Research

4.0006, RADIOFREQUENCY RADIATION EFFECTS ON EXCITABLE TISSUES
E.C. Burdette, Georgia Inst. of Technology, Engineering Experiment Station, Systems & Techniques Laboratory, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF054830; F49620-79-C-0055)

AF function - Air Force operating environments expose personnel to a wide variety of potential hazards which may limit or degrade man's ability to perform effectively. Current methods are not adequate to assess the biological effects of single, sequential or long-term exposure to electromagnetic radiations (EMR). Fundamental data on the bioeffects of microwaves are necessary for the establishment and maintenance of adequate EMR safety criteria. Deficiency - very little is known about cellular level bioeffects of electromagnetic radiation. Although non-thermal effects of EMR on cardiac and neuronal tissue have been suggested, no hard experimental evidence exists upon which an accurate assessment of bioeffects on excitable tissues can be based. Objective - the objective of the proposed research is to determine if pulsed microwave radiation alters normal physiological functions of cardiac cell aggregates. How research contributes - data obtained from these experiments will enable more accurate reappraisal of Air Force and occupational personnel exposure standards for microwave radiation. This research will support and contribute to RO 1.8.1.2, electromagnetic radiation.

An exposure system will be designed to provide proper dosimetry of EMR for exposure of cardiac cell aggregates (CCA). Following dosimetry and thermal alteration studies, cardiac aggregate clusters will be exposed to both continuous wave and at least four pulsed-wave EMR conditions using an exposure frequency of 2450 mHz and two absorbed power levels. The effect of EMR on CCA's will be evaluated using the following parameters: beat rate, maximum diastotic potential, action potential duration, slope of pacemaker potential, maximum upstroke velocity and threshold potential alterations. These cellular interactions are the initiating activity for macroscopic-level functions. The aggregates offer not only a sensitive system in which to

study fundamental effects, but also a means by which these effects may be related to gross responses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, FINITE STRAIN CREEP AND CREEP CRACK GROWTH ANALYSIS
S.N. Atluri, Georgia Inst. of Technology, School of Engineering Science & Mechanics, *Atlanta, Georgia* 30332 (NAG 3-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0008, ARTIFICIAL INTELLIGENCE AND HUMAN ERROR PREVENTION
R.T. Chien, University of Illinois, Urbana Champaign Campus, School of Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (FA79-WA-4360)

Basic research on the conceptual design of an on-board intelligent computer system is being carried out. The system will do intelligent monitoring and diagnosis of an aircraft and its operations. A knowledge base encompassing all aspects of flight knowledge is being organized and will be used with a problem solver for planning and execution of procedures.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0009, AN EXPERIMENTAL INVESTIGATION OF UNSTEADY TURBULENT BOUNDARY LAYERS 15780-E
B.R. Ramaprian, University of Iowa, School of Engineering, Dept. of Mechanics & Hydraulics, *Jessup Hall, Iowa City, Iowa* 52240 (DA0G8968; DAAG29-79-G-0017)

To experimentally investigate the structure and behavior of turbulent boundary layers in the presence of sinusoidally oscillating freestream. Relevance - the research is relevant to the analysis and ultimate modification of helicopter dynamic stall and then to the design and control of linkage loads on helicopter blades.

The study will be performed in an oscillatory-flow water tunnel in which both amplitude and frequency of oscillation as well as the mean velocity can be varied. In addition to mean and fluctuation velocities, details of the turbulence structure will be measured.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0010, STATIC AND DYNAMIC NON LINEAR ANALYSIS WITH SUBSTRUCTURE MODELS
R.H. Dodds, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Mechanical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 3-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0011, DESIGN OF VARIABLE STRUCTURE CONTROL SYSTEMS
S.H. Wang, University of Maryland, College Park Campus, School of Engineering, Dept. of Electrical Engineering, *College Park, Maryland* 20742 (NAG 1-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0012, ELECTROCHEMICAL EVALUATION OF THE ELECTRONIC AND TRANSPORT PROPERTIES OF SILICON
R.D. Rauh, E I C Corp., *55 Chapel St., Newton, Massachusetts* 02158 (DAR79-17409)

The purpose of this research is to demonstrate an electrochemical method to evaluate electronic and transport properties of silicon. The technique makes use of the Schottky-type barrier which forms between semiconductors and certain redox electrolytes. The electrical and optical properties of such a barrier can be employed to determine doping densities, as well as carrier diffusion lengths, lifetimes and mobilities. Presently, it is necessary to fabricate metal-semiconductor Schottky diodes to make such measurements, a process which is time-consuming, destructive and requires high-vacuum preparative techniques. Hence, successful completion of the proposed research could lead to substantial facilitation of quality control in Si device fabrication.

In order to make electrochemical measurements on Si, electrolytes must be developed to stabilize its surface against passivating oxidation, a problem which is addressed in the Phase I feasibility research. Also in Phase I, an analysis of the C-V behavior of the Si electrode in these stabilizing electolytes is proposed, which yields the doping density and demonstrates the general utility of the approach. In Phase II, the method is expanded to cover a wider range of optical and electrical measurements, and practical modifications of the measurement apparatus are considered.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

4.0013, IMAGING ALL-SKY PHOTOMETER
R.H. Eather, Keo Consultants, *Newton, Massachusetts* (R; F19628-76-C-0168)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft, number 53131, will allow comprehensive measurements of ionospheric response to substorms over subauroral, auroral and polar cap domains.

Design, develop and construct an ultra-high-sensitivity, low-light-level T.V. system capable of wavelength discrimination, all-sky viewing and signal processing to accurately measure auroral emissions in the visible region of the spectrum.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0014, DEVELOPMENT OF SINGLE MODE, HIGH TEMPERATURE CONTINUOUS WAVE (CW) PLUMBUM-STANNUM-TELLURIUM (PBSNTE) LASER DIODES
C.G. Fonstad, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0015, ADVANCED STRESS ANALYSIS OF TURBINE ENGINE STRUCTURES
T.H. Pian, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 3-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0016, RESEARCH ON VISUAL VESTIBULAR INTERACTION AND ITS APPLICATION TO FLIGHT SIMULATION
L.R. Young, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 2-12)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0017, REMOTE SENSING OF OCEAN SURFACE AND ICE CONDITIONS USING MICROWAVES
R.E. McIntosh, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (NAG 1-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0018, PHOTOELECTROLYSIS OF WATER WITH SURFACE MODIFIED METAL OXIDE ELECTRODES
M. Tomkiewicz, City University of New York, Brooklyn College, School of Science, Dept. of Chemistry, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (NAG 1-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0019, PROPOSAL STRUCTURAL DYNAMICS STUDIES FOR FAN/TURBINE DESIGN
R.G. Loewy, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engineering, *110 8th St., Troy, New York* 12181 (NAG 3-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0020, VIBRATION ANALYSIS OF TURBINE ENGINE BLADES
A.W. Leissa, Ohio State University, Columbus Campus, School of Engineering, Dept. of Engineering Mechanics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 3-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0021, ZERO MODULES AND INVERSE SYSTEM DESIGN
B. Wyman, Ohio State University, Columbus Campus, School of Engineering, Dept. of Engineering Graphics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 2-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0022, DIGITAL TELEVISION SIMULATION FACILITY
S.C. Kwatra, University of Toledo, School of Engineering, Dept. of Electrical Engineering, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NAG 3-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0023, ULTRASONIC RANGING FOR THE OCULOMETER
W.J. Guy, Lafayette College, Undergraduate School, Dept. of Electrical Engineering, *Easton, Pennsylvania* 18042 (NAG 1-45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0024, A STUDY OF SOLAR ENERGY RADIO FREQUENCY GENERATION DEVICES
J.W. Freeman, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAG 3-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0025, THE DEVELOPMENT OF THE MINICOMPUTER/GLOBAL BUS INTERFACE FOR THE FINITE ELEMENT MACHINE
J.H. Aylor, University of Virginia, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 1-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0026, NUMERICAL ALGORITHMS FOR FINITE ELEMENT COMPUTATIONS ON ARRAYS OF MICROPROCESSORS
J.M. Ortega, University of Virginia, School of Engineering & Applied Science, Dept. of Applied Mathematics & Computer Science, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 1-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0027, RADIATION VIEWFACTOR ANALYSIS
A.F. Emery, University of Washington, School of Engineering, Dept. of Mechanical Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (NAG 1-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, SEASAT PROGRAM - USE OF SEASAT DATA TO INVESTIGATE CONNECTIONS BETWEEN SEA-SURFACE TEMPERATURES AND METEOROLOGICAL FACTORS
S.A. Bowling, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (7-925; MO-A01-78-00-4321)

OBJECTIVE: The use of SEASAT-A SMMR sea-surface temperature and wind speed data to examine the immediate effect of meteorological events, especially cyclone passages on sea-surface temperatures in the Gulf of Alaska/Aleutian area.

APPROACH: The SMMR data will be processed by differencing of temperatures obtained at different times to obtain maps of cooling/heating rates, which will then be compared both with SMMR-derived wind speeds and with conventional meteorological data. Conventional meteorological data will be used to select three periods during winter 1978-79, during fall, mid-winter and early spring. SMMR geophysical data tapes will be obtained during these periods, as well as IR imagery, if available. Major emphasis will be on patterns of temperature change relative to the positions of major meteorological features, and identification of those which are consistent enough to have a high probability of being real.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0002, AGGREGATE FORMATION AND AEOLIAN ACTION ON MARS
D. Krinsley, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAGW 24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0003, PLANETARY AND MARS GEOMORPHOLOGY
M.C. Malin, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NAGW 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0004, SEASAT PROGRAM - INTEGRAL INVERSION OF SEASAT - COMPARISON OF DERIVED SWELL AMPLITUDES & RMS WAVEHEIGHT WITH SURFACE TRUTH (ABBREV)

B.J. Lipa, S R I International, Remote Measurements Laboratory, *333 Ravenswood Ave., Menlo Park, California* 94025 (7-923; MO-AO1-78-00-4319)

OBJECTIVE: Develop a integral inversion technique which when applied to Seasat Altimeter data will give the functional form of the ocean surface height probability density.

APPROACH: The derived probability functions will be interpreted in terms of swell amplitude and from waveheight of wind-derived waves. These results will then be compared with surface truth measurements obtained in the Joint Air-Sea Interaction (JASIN) experiment and the Gulf of Alaska experiment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0005, A PROPOSAL TO USE TIROS-N AVHRR DATA FOR MEASUREMENTS OF ATMOSPHERIC AEROSOLS

M. Griggs, Science Applications Inc., Remote Sensing Division, *1200 Prospect St., La Jolla, California* 92037 (8-683; MO-A01-78-00-4092)

OBJECTIVE: Develop a technique to infer atmospheric aerosol particle concentration over the earth's oceans using measurements of reflected solar radiation from the Advanced Very High Resolution Scanning Radiometer (AVHRR) on the TIROS-N series of satellites. Use this technique to produce maps of aerosol particle concentration.

APPROACH: During the first year, methods to simplify the mathematical representation of the relationship between reflected radiance and aerosol concentration for different viewing and solar zenith angles will be studied. Theoretical computations of the radiance of radiation reflected from the ocean and atmosphere at a particular wavelength, for solar zenith and satellite viewing angles expected for TIROS-N, and for aerosol particle concentrations varying from none to ten times normal, will be performed and analyzed. Simpler methods will be developed from this analysis.

Subsequent studies using coincident measurements of reflected radiance and aerosol concentration at several locations on the earth will test the validity of the mathematical representation and provide an empirical means of adjusting the expressions for better accuracy.

If these study results are positive, the technique will be developed into an operational product.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0006, SEASAT PROGRAM - EVALUATION OF OPEN OCEAN MEASUREMENTS BY THE SEASAT-A SYNTHETIC APERTURE RADAR DURING THE 1978 JOINT AIR-SEA INTERACTION

A.M. Peterson, Stanford University, Center for Radar Astronomy, *Stanford, California* 94305 (7-922; MO-AO1-78-00-4318)

OBJECTIVE: The extensive wind and wave measurement to be made during the Joint Air-Sea Interaction (JASIN) experiment will be utilized to evaluate the measurement of ocean wave directional spectra by the SEASAT-A SAR. Information will be obtained concerning the range of ocean wavelengths and observational parameters over which reliable measurements of directional spectra can be made using SAR images, the dominant radar wave/ocean wave interaction mechanism(s) which allow SAR to image long wavelength ocean waves and then effects of local winds on SAR images.

APPROACH: The SEASAT-A/JASIN collaborative research effort will include SAR data collection for the JASIN area; SAR images formation, including geometric and focussing corrections; SAR image processing; comparison of SAR and surface measurements sigma (k, Omega); and evaluation of SEASAT-SAR measurements of sigma. The principal conclusion to be drawn from the data comparison is over what range of observational parameters, and wind and wave conditions, can SEASAT SAR images be used to provide meaningful estimates of the ocean wave directional spectrum.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0007, AERIAL PHOTO SPECIFICATIONS FOR FORESTRY

R.N. Colwell, University of California, Berkeley Campus, Agricultural Experiment Station, Dept. of Forestry & Conservation, *Berkeley, California* 94720 (0010844; CA-F#-FRU-1329)

OBJECTIVE: Determine, for forested areas, the type of aerial photography from which information essential in the practice of forestry can be most accurately and readily extracted.

APPROACH: The work will be designed so as to permit a determination of the relative ease and accuracy with which forest composition, vigor, density, size, age structure, and land features can be recognized on photography taken with various film-filter combinations, at various scales, and at various times of the day and year. Spectrophotometric analyses of the objects and conditions to be identified will first be made, in order to select the film-filter combinations which theoretically will provide the best photographic tone or color contrasts. Aerial photography of representative forest areas will then be flown with the selected film-filter scale combinations at various times of day and year. Through photo interpretation, estimates will be made from each set of photos as to forest conditions existing within the test areas. The accuracy of the interpretations will be determined by field checking, so that the specifications for optimum forest photography can be formulated.

PROGRESS: In June, 1978, multiband photography was obtained from an altitude of 21,000 meters above the terrain through the use of a NASA U-2 Aircraft as it flew over our remote sensing test sites in Mendocino County, Calif. The following 3 film-filter combinations were employed: Panchromatic film with a Wratten 12 filter; Infrared Ektachrome film with a Wratten 89B filter; and Aerial Ektachrome film with an HF-2 filter. For this purpose 3 identical cameras were operated simultaneously, each having a 12-inch focal length and a 9" x 18" negative size. From a light aircraft operated at 500 meters above the terrain we also took simultaneous photography of selected portions of the area, using the same 3 film-filter combinations. From our comparative interpretations of these 3 combinations we conclude that: (1) The Infrared Ektachrome photography is superior for (a) mapping fuel conditions in brushfields and selecting the specific areas within which fuel modification measures might best be employed such as prescribed burning, mechanical removal of brush, chemical control of brush and drill seeding following brush removal. (Text Abridged)

SUPPORTED BY California State Government

5.0008, RECENT STUDIES IN CLOUD PHYSICS & THEIR RELEVANCE FOR A BETTER UNDERSTANDING OF AIRCRAFT ICING

H.R. Pruppacher, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Atmospheric Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 4-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

5.0009, HIGH PRESSURE COSMOCHEMISTRY APPLIED TO MAJOR PLANETARY INTERIORS

D.J. Stevenson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Earth & Space Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0010, MEASUREMENTS OF KEY BIOGEOCHEMICAL GASES AND THEORETICAL STUDIES IN ATMOSPHERIC CHEMISTRY

R.J. Cicerone, University of California, San Diego Campus, Graduate School, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (NAGW 45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0011, RESEARCH RELATIVE TO IMPROVEMENTS IN BENCHMARK STABILITY FOR PRECISION TILT MEASUREMENTS OF CRUSTAL DYNAMICS

J. Berger, University of California, San Diego Campus, Inst. of Geophysics & Planetary Physics, *8602 La Jolla Shores Dr., La Jolla, California* 92038 (NAG 5-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0012, MODELING THE RELATIONS OF LAND USE/LAND COVER TO RESOURCE DEMANDS

C. Clayton, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NAG 2-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0013, PRIME AGRICULTURAL LAND MONITORING AND ASSESSMENT COMPONENT OF THE CALIFORNIA INTEGRATED REMOTE SENSING SYSTEM

J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NAG 2-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0014, REMOTE SENSING OF PHYTOPLANKTON - REFLECTANCE SPECTROSCOPY OF MARINE BACTERIA AND COLLOIDS

D.A. Kiefer, University of Southern California, School of Letters Arts & Sciences, Dept. of Biological Sciences, *3551 University Ave., Los Angeles, California* 90007 (7-717; 04-7-158-44123 MOD. NO.1)

OBJECTIVES: (1) To investigate the quantitative relationship between bacteria and colloids in the ocean and the spectral characteristics (color variations) of the water as seen from a spacecraft; and (2) to provide ship and scientific technical support during the Nimbus G/CZCS (Coastal Zone Color Scanner) post-launch experiment in February-March 1979.

APPROACH: (1) Current laboratory investigations into the relationship between changes in the diffuse spectral reflectance of the ocean and the presence of particles less than 1.0 micron in diameter (marine bacteria and colloids) will be extended by the use of reflectance spectroscopy. Specifically, the absorption and backscattering coefficients for common marine bacteria and isolated marine colloids will be determined from samples of southern California coastal waters. The bacteria will be concentrated using differential filtration techniques, whereas the colloids will be concentrated by ultra-filtration methods. (2) University of Southern California will provide a 110-foot research vessel, the R/V Velero IV, together with scientific/technical personnel, to conduct a 20-day cruise of southern California coastal waters. The measurements to be made, which include chlorophyll A and pheophytin A concentration, sea temperature, and phytoplankton nutrients, are not only to provide surface truth during Nimbus G/CZCS overflights, but are to be used to extend the utility of the satellite data to times and places where surface truth is lacking. NESS scientists will be aboard to collect concurrent optical and particle size distribution data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0015, COMPARATIVE PLANETARY AERONOMY - VENUS STUDIES

S. Kumar, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NAGW 57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0016, METEOROLOGICAL OBSERVATIONS

L.O. Grant, Colorado State University, Agricultural Experiment Station, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (0009900; COL00104)

OBJECTIVE: Obtain meteorological data at the Colorado Experiment Station. Establish the climatology and climatological changes at the observing point. Obtain meteorological data to assist in aircraft flight forecasting by the National Flight Control System.

APPROACH: Complete observations are taken at 7:00 am and 7:00 pm MST. Airway observations are made 12 times each day on odd hours. The data are relayed by TWX to the Weather Bureau in Denver for dissemination via teletype.

PROGRESS: Meteorological observations are made at the University Weather Station to support agricultural and engineering research and to assist in operational aspects of flight forecasting by the U.S. Weather Bureau. Weather observations have been made at this station since 1873, and continuously since 1887. Parameters observed include: sky conditions, present weather, pressure, earth temperature, soil temperatures, humidity, wind, radiation, dew and frost deposition and evaporation during ice-free seasons. Complete observations are made twice daily at 7 a.m. and 7 p.m. MST. Airways observations are made 12 times daily on all odd number hours. All of the station records from 1890 to 1972 have now been transferred to computer tapes. The compilation of a comprehensive climatology based on the availability of the computer tapes has been deposited with the Colorado State Climatology Office. A limited observation setup at the Foothills location in cooperation with the Colorado State Forest Service and the Department of Atmospheric Science allows contrast between the foothills and main campus sites as well as providing forest fire weather data and data related to foothills grazing lands. The findings include daily operational and bench mark meteorological observations.

SUPPORTED BY Colorado State Government

5.0017, REMOTE SENSING FOR RENEWABLE NATURAL RESOURCE INVENTORY AND LAND MANAGEMENT EVALUATION

R.C. Aldrich, U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest & Range Experiment Station, *240 W. Prospect St., Fort Collins, Colorado* 80521 (0045934; RM-4155)

OBJECTIVE: Improve, develop, and implement remote sensing technology for increased efficiency of renewable resource inventory and to provide procedures to land management planners on use of remote sensing for resource management.

APPROACH: Remote sensing technology will be developed by: Developing procedures to apply current remote sensing technology for multipurpose resource inventories, providing procedures for detecting and monitoring change in forest and rangelands, and developing efficient and effective procedures to normalize remote sensing data.

SUPPORTED BY U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest & Range Experiment Station

5.0018, SOLAR EXTINCTION RADIOMETRY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0019, BALLOON-BORNE SPECTROMETER MEASUREMENTS OF ULTRAVIOLET VISIBLE SOLAR LIMB EXTINCTION

D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (NAG 1-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0020, REMOTE SENSING OF ESTUARINE DETRITAL FLOW AND SURFACE WATER PRODUCTIVITY

V. Klemas, University of Delaware, School of Marine Studies, Dept. of Geography, *Lewes, Delaware* 19958 (R/B-7)

OBJECTIVES: To develop and apply remote sensing techniques to map synoptically over large areas, the form and magnitude of detritus and chlorophyll contributions from the marsh to the estuarine and coastal environment. Two techniques will be investigated and results compared with surface measurements: 1. Eigenvector analysis of multi-spectral digital imagery to map the concentration and flow of detritus and chlorophyll. 2. Airborne laser fluorosensing of the chlorophyll as an indicator of surface water productivity.

The surface measurements will include the dry weights and ash-free dry weights of the particulate material for three different size fractions, and the DOC and POC content of the filtrate and filtered materials. The flux of organic materials will be determined by incorporating both concentrations and water volume transports for the flood and ebb of each tidal cycle.

ANTICIPATED BENEFITS: This work will help evaluate the potential and real contribution of salt marsh ecosystems to the marine environment by providing synoptic data on the distribution and flow of detritus and chlorophyll from the marsh into the estuaries and coastal waters. It will help provide answers to these questions: What are the form and mangitude of detritus contribution and subsequent fate of detritus in the estuarine-coastal environment? How do such detritus contributions influence life processes and dynamics of the estuarine environment?

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0021, DEVELOPMENT OF AN AIRBORNE LASER PHOTOFRAGMENTATION

D.D. Davis, Georgia Inst. of Technology, School of Geophysical Sciences, *Atlanta, Georgia* 30332 (NAG 1-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0022, RESEARCH ON REMOTE SENSING AND GEOLOGIC STUDIES OF THE LUNAR CRUST

B.R. Hawke, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NAGW 42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0023, REMOTE SENSING OF IOWA'S AGRICULTURAL AND FORESTRY RESOURCES

R.E. Carlson, Iowa State University of Science & Technology, Iowa Agricultural & Home Economics Experiment Station, Dept. of Agronomy, *Beardshear Hall, Ames, Iowa* 50010 (0064179; IOW01997)

OBJECTIVE: Refine and improve remote sensing-photo interpretation procedures relating to Iowa's natural resources in problems dealing with classification and inventory of agricultural and forest lands and the detection of adverse stresses in these ecosystems.

APPROACH: Standard photo-interpretive procedures and new technology, as available, will be incorporated to extract information from existing and proposed aerial imagery to develop classification schemes to inventory soils, crops, forest land and the extent of diseases in crops and trees at selected test sites in Iowa. It is anticipated that the information extracted at test sites can be extended to areas not physically examined on the ground, but covered by aerial imagery. Basically, we hope to consolidate our expertise from different fields to maximize the information with respect to agriculture available from remote sensors.

PROGRESS: FORESTRY: Extensive analysis of a wide spectrum of photographic imagery has led the investigators to endorse Conventional Color Imagery as the most ideal base for interpreting the optimum range of vegetation and habitat features. The diagnostic opportunities by changes in the appearance of forest communities and individual species as recorded by conventional color photographic sensors owing to phenological events is exploited to greatest advantage. The chance success of tree recognition from film types relying primarily on spectral analysis has been reduced by investigating and recording the temporal dates of phenological events for the 16 forest communities predominant in the Iowa landscape and the dominant individual species characteristic of each. Selected stero photographs will be presented for interpreter use that captures unique temporal signatures for each forest community during critical event periods and forms the backbone of the Interpretive Keys for Forest Community Analysis Using Low Altitude Conventional Color Aerial Photography. CORN: Data collection describing soybean growth and development under different soil moisture conditions continued in 1978 after the drought plagued 1977. These data are being assembled to develop a new soybean model or to test existing soybean models. Seven cultivars of differing maturity were tested in 1978 and all responded to supplemental irrigation.

SUPPORTED BY Iowa State Government

5.0024, COUPLING OF THE NITROGEN-OXYGEN X AND SULFUR OXYGEN X CYCLES IN THE TROPOSPHERE

M.B. Ragg, University of Iowa, Graduate School, *4 Jessup Hall, Iowa City, Iowa* 52240 (NAG 1-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0025, EFFECTS OF MINING AND LAND RECLAMATION ON HYDROLOGY OF SOUTHEASTERN KANSAS

A.M. Diaz, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Lawrence, Kansas* 66044 (KS 77-081)

Effects of past and present mining of coal, lead, and zinc in southeastern Kansas has caused degradation of streams draining the mined areas. Quantitative measures of the degradation and identification of source areas are needed to assess the effectiveness of pollution-control measures, the possible need for changes in mining and reclamation procedures, and design of a long-term quality-monitoring network in southeastern Kansas.

The objectives of this project are to apply the extensive water-quality data being collected in Project KS 76-076 and remotely sensed data from aircraft and LANDSAT to (1) identification from computer-enhanced imagery of point-source areas where poor-quality water discharges from old shaft mines, strip pits, collapsed areas, spoil embankments, and reclaimed areas, (2) evaluation of land-reclamation effects on water quality by analyzing areal and temporal changes in vegetative vigor in reclaimed areas, (3) establishment of a continuing monitoring program using computer-enhanced imagery to detect anomalies associated with acid drainage, and (4) use of results from above activities to design an improved long-term water-quality-sampling network for the mining area in southeastern Kansas.

Remote-sensing techniques will be used to obtain data for analysis with signal-enhancement systems and digital densitometers to discriminate differences in water quality, degrees of vegetative vigor, and 'hot spots' in mined areas vs. natural areas. The analyses will aid identification of sources of stream-quality degradation related to drainage from shaft mines, stripped areas, collapsed underground workings, and coal-processing activities. Photography and imagery will be obtained repetitively from aircraft and, as appropriate, from LANDSAT for comparison to water-quality data from Project KS 76-076. Additional ground-truth data will be collected in anomolous areas identified from the remotely sensed data. Finally, the data will be used to design a long-term quality-monitoring network in southeastern Kansas.

Multispectral-remote sensing data were obtained by the contractor, Daedalus Enterprises. Concomitant ground-level data were obtained from field measurements and chemical analyses of water samples from 30 sites in Cherry Creek. Preliminary review and analysis was begun for the remote sensing data. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0026, ELECTRON POSITIVE ION INTERACTION

R.J. Henry, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (NAGW 45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0027, SEASAT PROGRAM - RESEARCH APPLICATIONS WITH TROPICAL CYCLONE DATA SETS

R.C. Gentry, General Electric Co., Management & Technical Services, *5030 Herzel Pl., Beltsville, Maryland* 20705 (7-931; MO-AO1-78-00-4323)

OBJECTIVES: Use wind, temperature and moisture measurements from SMMR and SASS, together with all other available data sets taken over three tropical cyclones, to evaluate usefulness of SEASAT-A for hurricane observations. Compare value of this full data set with requirements for making hurricane forecasts.

APPROACH: SEASAT data will be obtained on a moderate disturbance, a tropical storm and a tropical cyclone of full hurricane intensity. All three cases will be selected to insure maximum data availability, but the full hurricane case would further cover periods when the geosynchronous satellite is operating in the limited scan mode for the storm area and the NOAA Research Flight Center has one or more of its aircraft gathering data in the storm at low levels. Data from all sources will be intercompared in order to assess data validity and to set limits on probable errors in the various types of data. These data would then be used to study the structure and energetics of the three storms of varying intensity.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0028, EVALUATION OF NEW REMOTE SENSING INSTRUMENTATION OF AGRONOMIC CROPS

J.H. Elgin, U.S. Dept. of Agriculture, Federal Research Office, Plant Genetics & Germplasm Inst., Field Crops Lab., *Bldg. 001, Room 335, Beltsville, Maryland* 20705 (0044246; 1108-20100-003)

OBJECTIVE: Undertake cooperative research with NASA scientists in identifying optimum parameters for making equipment recommendations for satellites and space shuttle. Develop remote sensing and monitoring techniques on agronomic crops.

APPROACH: In consultation with NASA scientists, develop field cropping systems for remote sensing reflectance experiments. Detailed agronomic data will be collected for all cropping systems and correlations with NASA remotely sensed spectral measurements will be determined. Based on results of this research, recommendation for new remote sensing equipment will be made.

PROGRESS: Extensive small plot plantings of wheat, soybeans, corn, and alfalfa, as well as some large field plantings of corn, soybeans, and wheat, were made in 1978. Agronomic data pertaining to stage of crop development, crop cover, plant height, disease and insect damage, drought stress, and crop yields were taken weekly or as appropriate. Concurrent with the collection of the agronomic data, NASA personnel monitored the plots with remote sensing equipment, including a small hand-held, two-band (IR and RED) radiometer, a larger truck-mounted spectroradiometer, and a truck-mounted microwave sensor. Although analyses of most data are incomplete, preliminary indications show that the increase in green vegetative tissues of all crops can be 'tracked' with the IR and RED radiances from the hand-held radiometer, and that these measurements can be related to yield.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Beltsville Agricultural Research Center

5.0029, EVALUATION OF NEW REMOTE SENSING INSTRUMENTATION ON AGRONOMIC CROPS

J.B. Powell, U.S. Dept. of Agriculture, Federal Research Office, Plant Genetics & Germplasm Inst., Field Crops Lab., *Bldg. 001, Room 335, Beltsville, Maryland* 20705 (0045764; 1108-20760-001)

OBJECTIVE: Develop remote sensing techniques to predict crop yield and to detect plant stress for use in early warning. Develop a cooperative research effort with NASA scientists in identifying optimum parameters for monitoring agronomic crops and for making instrumentation recommendations for satellites and space shuttle.

APPROACH: In cooperation with NASA scientists, develop field cropping systems for studying remote sensing reflectance under controlled experimantation. Collect detailed agronomic data for all cropping systems and correlate with spectral measurements. Based on results of this research, recommendations for new remote sensing instrumentation and utilization of remotely sensed data will be made.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Beltsville Agricultural Research Center

5.0030, VOLCANIC IMPACT ON STRATOSPHERIC AEROSOL CHEMISTRY

W.H. Zoller, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Chemistry, *College Park, Maryland* 20742 (NAG 2-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0031, A PROGRAM TO DEVELOP REMOTE SENSING EXCELLENCE

R.M. Ragan, University of Maryland, College Park Campus, School of Engineering, Dept. of Civil Engineering, *College Park, Maryland* 20742 (NAGW 33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0032, EXPERIMENTAL STUDIES OF THE SOURCES OF ATMOSPHERIC GASES

M.B. McElroy, Harvard University, Cambridge Campus, School of Engineering, Dept. of Engineering & Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 1-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0033, APPLICATION OF TELEOPERATORS TO UNDERSEA TASKS

T.B. Sheridan, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (R/U-1)

OBJECTIVES: To develop improved techniques for performing a variety of undersea manipulation and sensing tasks, tasks which are largely unpredictable, by means of teleoperation a submersible with general purpose arms, hand and video/sonar/tactile sensors which are servocontrolled by a human operator on the surface.

This research would: provide a framework for matching present undersea tasks and available teleoperator tools, especially with respect to economic trade-offs with use of human divers; provide 'baseline' demonstrations and performance data of human controlled teleoperation in specific candidate tasks; develop new techniques for computer augmentation of teleoperators for primitive reflexive control, where the laboratory demonstration of teleoperator sensing and manipulation of a non-

cable tethered submersible have all communication and control through a sonic link.

Because of the fatality rate and the high dollar cost of human divers or manned submersibles, and because of increasing requirements to deep operations, telemanipulation promises significant safety and economic advantages.

ANTICIPATED BENEFITS: Our analysis and laboratory demonstrations should be useful to the undersea operation companies, oil companies, manufacturers of undersea exploration and construction equipment and to the U.S. Government in assessing the usefulness of computer aided teleoperators for a variety of undersea tasks. We will request these companies and agencies to review our work and confer with us.

Further, we plan to collaborate with Harbor Branch Foundation and Woods Hole Oceanographic Institute on demonstrations of our techniques on actual diving equipment.

IDENTIFIED BENEFITS TO DATE: A verbal taxonomy of tasks and variables has been developed through the survey of existing data, the conferring with many experts and practitioners, and the visiting of facilities both in the U.S. and abroad.

This project has provided master's thesis research for two students and a bachelor's for a third, and has contributed to the Ph.D. work of a fourth.

A laboratory manipulator has been refurbished and interfaced with a computer for use in demonstrating techniques that are being developed. Associated analyses have been completed. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0034, THERMAL HISTORIES OF LUNAR ROCKS
D.R. Uhlmann, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgical & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0035, HYDROLOGIC-OCEANOGRAPHIC INTERRELATIONS
F.A. Kohout, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Woods Hole, Massachusetts* 02543 (NR 66-042)

Geophysical and drilling programs are being developed to evaluate the potential value of energy resources on the outer continental shelf (OCS) for lease sales and to appraise the environmental impact of development. At the inner margin of the OCS lies the arbitrarily defined coastal zone which includes strand line, estuaries, bays, rivers and contiguous land areas adjacent to the coast. At present one-half of the U.S. population lives in the coastal zone and 80% is projected for the year 2000. Thus, the need for an interdisciplinary study is obvious.

The position of the transition zone between fresh and salt water in coastal aquifers is an important initial boundary condition required for predictive mathematical modeling of salt-water intrusion. A technical objective is to investigate water circulations between the ocean, estuaries and bays and the underlying permeable strata and observe the various phenomena of groundwater discharge such as submarine springs. A second objective is to provide liaison with the Geologic Division, USGS, in OCS investigations. Identification of the seaward extension of aquifers and geologic formations in OCS drill holes will aid (1) in evaluating the energy and mineral resources of the OCS, (2) in appraising the impact of OCS resource development on environmental values of the coastal zone, (3) in fixing the position of the fresh-salt transition zone in ground water for predictive mathematical model studies of salt-water intrusion.

Investigation of water, energy, and mineral resources is accomplished by correlating chemical, thermal, turbidity, and remote sensing observations of surface and ground waters with geologic and bathymetric features of the OCS and coastal zone determined by geophysical surveys and exploratory drilling. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0036, MARS - MINERALOGY OF THE SURFACE MATERIALS
R.L. Huguenin, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Physics, *Amherst, Massachusetts* 01002 (NAGW 40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0037, SEASAT PROGRAM - BATHYMETRY AND BOTTOM TOPOGRAPHY MAPPING
R.A. Schuchman, Environmental Research Inst. of Michigan, Radar & Optics Division, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (7-978; MO-AO1-78-00-4339)

OBJECTIVE: The investigation is concerned with the application of the SEASAT Synthetic Aperture Radar (SAR) to measure ocean wavelengths undergoing wave refraction and relating these changes to the presence of islands, shoals, and water depth.

APPROACH: Examine SEASAT SAR data collected over the Gulf of Alaska and select an SAR pass that has noticeable wave refraction present. The radar-equipped Canadian Convair 580 aircraft will also collect data over the Gulf of Alaska test site. A clear water test site in the Carribean will be selected for targets of opportunity. Selected portions of two acquired SEASAT passes will be digitized, and geometry and radiometric distortions in the SEASAT data will be corrected digitally. The data will be reduced into bathymetry maps using an oceanographically acceptable wave refraction model and the results will be compared to all available sea truth. The SAR image output data is to be corrected optically for geometric effects. Image data will be corrected optically to enhance wave trains and obtain spectra at selected locations; these data would then be reduced into a bathymetry map and compared.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0038, HORIZONTAL MAPPING OF THE THERMAL STRUCTURES OF THE MESOSPHERE AT 85 AND 97 KILOMETERS
J.W. Meriwether, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NAGW 32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0039, CONDENSATION NUCLEI MEASUREMENTS IN THE STRATOSPHERE FOR THE NASA ACE PROGRAM
B.Y. Liu, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (NAG 2-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0040, REMOTE SENSING APPLICATIONS TO FOREST, WATER AND RANGELAND RESOURCE MANAGEMENT
M.P. Meyer, University of Minnesota, St. Paul Campus, School of Forestry, Dept. of Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0023512; MIN-42-037)

OBJECTIVE: Significantly improve the data-gathering and analysis capabilities of research scientists, planners and managers in forest, water and rangeland resources development fields.

APPROACH: Definition of the problem - final selection on basis of need and potential for ultimate application to greatest number of users and/or resource values (relative cost-effectiveness). Design of project - accomplished, insofar as possible, in cooperation with interested, potential users; equipment package, timing selection of vegetation stage, overflight plan, coordination w/ground cooperators and ground truth needs definition and plans for collection and final analysis. Overflights/ground truth - image interpretation; image enhancement/analysis where

appropriate. Data analysis - review with, and possible assistance to adaptation by, the Cooperator-Users' report/publication.

PROGRESS: Habitat mapping of 64,000 ha. of coastal portions of Alaska were completed using 35mm CIR photos to analyze key areas and establish trend analyses. CIR 1:36,000 metric camera and small format photography were used to map 84,400 ha. of vegetation of the Miss. Riv. Headwaters. Classification of the wetlands of the 720,000 ha. TC Metro Area was accomplished with 1:24,000 CIR; these data used to test the capabilities of various other scales of CIR photography and digitally processed LANDSAT data. The status of change of the water surfaces and vegetation 1939-present on 43,300 ha. of Upper Miss. and Lower St. Croix Rivers determined by airphoto comparisons and field investigations. Color 35mm long focal length leaf-off vertical photography was tested to assess recreation developments on forested lakeshores. The applicability of 1:12,000 Cibachrome airphotos as a data base for vegetation management and Dutch Elm Disease detection is being tested in Duluth. Vegetation types of 80,800 ha. of forest peatlands in Minn. are being classified with 1:15,840 B and W airphotos supported by 35mm multi-camera multi-scale 35mm CIR transects and plots.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Minnesota

5.0041, DEVELOPMENT OF REMOTE SENSING EXPERIENCE AT THE UNIVERSITY OF MISSOURI-COLUMBIA

C.J. Johannsen, University of Missouri, Columbia Campus, School of Agriculture, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (NAGW 46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0042, MEASUREMENT OF THE DIURNAL VARIATION OF THE RADICALS IN THE UPPER ATMOSPHERE

W.H. Smith, Washington University, School of Arts & Sciences, Dept. of Chemistry, *4559 Scott Ave., St. Louis, Missouri* 63130 (NAG 1-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0043, EQUILIBRIUM CONDENSATION OF PLANETARY MATERIALS

S.K. Saxena, City University of New York, City College, School of Arts & Sciences, Dept. of Geology, *Convent Ave. & 138th St., New York, New York* 10031 (NAGW 59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0044, A STUDY OF THE MARTIAN FRETTED TERRAINS-LIGHTLY CRATERED TERRAINS BOUNDARY

D. Weiss, City University of New York, City College, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *Convent Ave. & 138th St., New York, New York* 10031 (NAGW 22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0045, SEASAT PROGRAM - GEODETIC STUDIES WITH SEASAT-A

M. Talwani, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (7-927; MO-AO1-78-00-4324)

OBJECTIVE: To examine altimeter data in the 100-200 km wavelength range for studying geoid anomalies related to specific geological and tectonic features, and finally to map oceanographic anomalies.

APPROACH: Gravimetric geoids will be constructed in the western North Atlantic and in the western Pacific for comparison with SEASAT-A data. These data are based on all available gravity data which have been carefully checked and are expected to yield the most accurate gravimetric geoids in those areas. Comparison between altimeter-determined sea surface heights and the gravimetric geoid will be used in estimating the sea surface topography attributed respectively to oceanographic phenomena and to gravity variations. The time varying part of sea surface topography may also be determined. The association of the geoid with several morphological and tectonic features of the world's oceans will then be established and refined; attempts will also be made to interpret the geoid undulation in geological and geophysical terms.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0046, RARE GASES IN METEORITES

O.A. Schaeffer, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NAGW 25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0047, RESPONSE OF SELECTED PLANT SPECIES TO SIMULATED EXHAUST MIXTURES/COMPONENTS FROM SOLID ROCKET FUELS

J.L. Apple, University of North Carolina, North Carolina State University, U.S. Dept. of Agriculture Federal Research Office, Air Pol Plant Growth & Development Research, *Raleigh, North Carolina* 27607 (0043024; 7092-20790-004-A(2))

OBJECTIVE: Develop a system to expose test plants to simulated exhaust of solid rocket motors. Develop a system for dispensing and monitoring component chemicals of solid rocket exhaust (HCl and Al(2)O(3)). Determine dose-response curves for single and multiple acute exposures of selected plant species, using injury and biomass as the prime response measures.

APPROACH: Exhaust exposures will be simulated by modifying present field chambers. Operation of the system assumes that the diameter and length of a solid rocket fuel 'bar' can be determined for a given length of burn and total pollutant loading. Twenty selected plant species will be screened to 4 concentrations of HCl or Al(2)O(3) for one hour. Based on results 8 species will be further screened using at 4 X 4 factorial design (concentration X time) for both materials. From these results selected plants will be screened using simulated exhaust systems. Plant injury, changes in leaf area, and changes in biomass will be determined.

PROGRESS: Greenhouse exposure chambers were built and tested for use with HCl gas and Al(2)O(3) particle. A controlled burn facility was designed and tested for exposing plants to fuel exhaust. Twenty-three native species, eight horticultural species (15 cv) and three agronomic species (8 var) were studied in at least one phase of this project. The injury threshold for a one hr exposure to HCl ranged fom less than 5 ppm to greater than 40 ppm. A few sensitive plants were injured in 10 min by 10 ppm of HCl. The horticultural and agronomic plants were most sensitive, the native were intermediate and the citrus were most tolerant to HCl. The Al(2)O(3) did not injure any of the plant either alone or in combination with HCl. Plant were about as sensitive to the fuel exhaust as to HCl, based on the HCl exhaust concentration. Mature valencia orange trees, Citrus sinensis, were sprayed with hydrochloric acid solutions of pH 2.0, 1.0, or 0.5 at the full-bloom stage or when new fruit was 0.5-1.5 cm in diameter and compared with a pH 7.8 control. The threshold pH for visible symptoms on flowers, leaves, petioles, stems and immature fruit was near 2.0. Injury was moderate at pH 1.0 and was severe at pH 0.5. The pH 2.0 solution did not affect the set and retention of new fruit. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Mid Atlantic Area

5.0048, THE INFRARED SPECTRAL ANALYSIS OF CF2CL2: APPLICATION TO ATMOSPHERIC DETECTION AND ABUNDANCE MEASUREMENTS FOR PLANNED IN-SITE EXPERIMENTS

R.J. Nordstrom, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (NAGW 31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0049, AUTOMATED MEASUREMENTS OF CALIBRATED CONCENTRATIONS (CO, CH4, AND CO2) AT SAMOA AND TASMANIA

R.A. Rasmussen, Oregon Graduate Center, Graduate School, Dept. of Environmental Technology, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (NAG 1-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0050, TEST OF THE LANDSAT-DATA COLLECTION SYSTEM IN THE SUSQUEHANNA RIVER BASIN

J.V. Funt, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *228 Walnut St., Harrisburg, Pennsylvania* 17108 (PA 73-051)

The potential use of earth orbiting satellite data relay systems for flood warning has not been well explored.

The objective of this project is to test the earth resources technology satellite-data collection system on key stream gages in the Susquehanna River Basin for flood warning.

Four data collection platforms will be field installed on stream gauges in the basin. Data relayed from the gauges will be provided to the Susquehanna River Basin Commission and the National Weather Service's River Forecast Center in Harrisburg.

Data collection platforms were installed at nine gauging stations in the Susquehanna River Basin for relaying data through the GOES satellite. Data collection platforms were operated at four gauging stations in the Susquehanna River Basin using the LANDSAT satellite to relay the data.

The operation of the LANDSAT data collection system will continue. The operation of the GOES data collection system will continue.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0051, CENTER FOR OCEAN MANAGEMENT STUDIES

V. Tippie, University of Rhode Island, Graduate School of Oceanography, *Administration Bldg., Kingston, Rhode Island* 02881 (A/COM-1)

OBJECTIVES: The Center for Ocean Management Studies was created in the fall of 1976 for the purpose of promoting effective coastal and ocean management. The center identifies ocean management issues, holds workshops and conferences to discuss these issues, and develops recommendations and programs to resolve them.

ANTICIPATED BENEFITS: Activities of the Center encourage better utilization of the resources in the ocean economic zone and the coastal zone. This is achieved by providing a forum of the discussion of ocean management problems and ways of resolving them. In addition, conferences, workshops, and seminars educate professionals and the public on ocean management issues. Better informed citizens will assure wiser management of the coastal and ocean resources.

IDENTIFIED BENEFITS TO DATE: It is too early to assess benefits, however the following progress is reported: The Center has encouraged interdisciplinary communication within the University through its 'inhouse' lectures, workshops, and newsletter. Its working committees on Fisheries Management, Coastal Zone Management, Marine Pollution, Multiple Resource Use, and Remote Sensing have provided a mechanism for the development of interdisciplinary programs within the University on these issues. The Center has also acted as liaison between the University and other institutions. At the regional and national levels, the Center has provided forums at which representatives from academic institutions, government agencies and private enterprises have discussed marine management problems such as: Oil spills, Estuarine/Shelf Coupling, Fisheries Management, Coastal Information Systems and Formulating Marine Policy.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0052, SEDIMENT TRANSPORT AND DEPOSITIONAL PATTERNS IN SELECTED COASTAL LAGOONS AND SALT PONDS, SOUTHERN R.I.

J.C. Boothroyd, University of Rhode Island, School of Arts & Sciences, Dept. of Geology, *Kingston, Rhode Island* 02881 (R/CL-4)

OBJECTIVES: The overall purpose of the proposed study is to define by field measurements some geologic parameters of the following Rhode Island coastal lagoons and salt ponds: 1) Ninigret/Green Hill complex; 2) Trustom; 3) Card; and 4) Pt. Judith/Potter complex.

The parameters to be determined are: 1) pathways of sediment influx into the lagoons/ponds; 2) modes of transport of sediment into the lagoons/ponds; 3) modes of transport of sediment within the lagoons/ponds; and 4) depositional sites of the sediment.

This information would be developed into a sediment transport and depositional model that would be available to workers in other disciplines and aid in resource management of the lagoon and pond system.

ANTICIPATED BENEFITS: The results of this effort integrated with the other proposals attempts to develop an understanding of coastal pond dynamics such that objective management decision can be made.

IDENTIFIED BENEFITS TO DATE: It is too early to identify benefits. The following progress is reported: Oblique aerial photography and geologic mapping at a scale of 1:6,000 has identified about 50 separate depositional environments in and around Ninigret/Green Hill and Pt. Judith/Potter Ponds. These can be divided into several groups of depositional environments with major deposition within the tidal-delta systems. Very little coarse-grained (sand) deposition is occurring presently in other areas of the ponds except as a subtidal lobe due to catastrophic overwash processes into Nimigret Pond behind the East Beach barrier spit. Hydrography station results indicate the same sort of sand movement pattern.

The depositional environments co-related well with the submerged macrophyte occurrence patterns of Harlin and Thorne-Miller in Nimigret Pond; and with the modeling results of Spaulding in Pt. Judith Pond.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0053, COASTAL ZONE MANAGEMENT AND MARINE ADVISORY SERVICE APPLICATIONS OF REMOTE SENSING

P. Cornillon, University of Rhode Island, School of Engineering, Dept. of Ocean Engineering, *Administration Bldg., Kingston, Rhode Island* 02881 (A/RS-1)

OBJECTIVES: 1. Prepare a Coastal Zone User's Manual of remote sensing for coastal management and marine advisory service personnel that: a) Summarizes existing sensors, sensor platforms and remote sensing data products applicable to the coastal zone. b) Identifies oceanographic and coastal variables which have been quantified in the past using remotely sensed data. 2. Sponsor a workshop directed primarily at the New York and New England coastal management and marine advisory service communities to: a) Obtain feedback from these potential remote sensing users as to what their data needs are in the area of management and advisory services. b) Provide for an exchange of information between potential suppliers and potential users of remote sensing data in the coastal regions. c) Critique and amend the manual prepared in item (1). 3. Define an interface which will encourage coastal managers and marine advisory specialists to become users of remotely sensed data.

ANTICIPATED BENEFITS: 1. Improved marine advisory and coastal planning capabilities as a result of improved

access to a large and growing data base. 2. Introduction of the New York/New England coastal communities to the potentials of remote sensing, the sources of such data and the specialists who interpret these data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0054, EVALUATION OF LANDSAT DATA FOR DISASTER ASSESSMENT AND PLANNING

D. Moore, South Dakota State University, Remote Sensing Inst., *Brookings, South Dakota* 57006 (AID/OFDA-147-79-03)

The purpose of this study is to evaluate the effectiveness of including LANDSAT data in flood disaster assessment operations.

In July, 1978, a disaster occurred in the Blue Nile Basin, Sudan, where rainfall in excess of 40 cm per day fell for three consecutive days. This resulted in severe flooding of parts of the Blue Nile and Gezira Provinces which include a flat sedimentary clay plain with little internal or surface drainage. The major damages were to recently planted cotton and millet crops and to irrigation canals of the Gezira Irrigation Scheme.

LANDSAT data were collected within two weeks after the peak of the flood. Historic LANDSAT data were available for temporal analysis. Technical assistance to conduct visual analyses of standard and enhanced photographic products plus digital analyses on man-machine interactive systems is being provided by OFDA under contract with the Remote Sensing Institute (RSI, South Dakota State University, Brookings, S.D.). Ground data provided through the Government of Sudan will be used to verify and update the interpretations from LANDSAT data. Recommendations to OFDA and similar organizations for the use of space technology will be documented by RSI concerning the type of data, viable analysis procedures, expected accuracies, and the use of remote sensing from LANDSAT in disaster assessment planning. The results of this investigation will be presented at the Fourteenth International Symposium on Remote Sensing of Environment sponsored in Costa Rica by the University of Michigan in April, 1979.

Research techniques have been developed to assess the spatial extent and levels of damage to the Gezira Irrigation Scheme. Evaluation of the use of LANDSAT for simulated disaster assessment operations will continue for several months at which time a paper will be prepared for delivery at the Symposium in Costa Rica.

SUPPORTED BY U.S. International Development Cooperation Agency, Agency for International Development

5.0055, REMOTE SENSING OF SO2 EFFECTS ON VEGETATION

C.D. Sapp, U.S. Tennessee Valley Authority, *401 Chestnut St., Room 268 - 248 401 Bldg., Chattanooga, Tennessee* 37401 (D9-E721-DJ; W833 -0054)

OBJECTIVE: To test, refine, and develop remote sensing instrumentation and techniques for monitoring the visible, previsual, and extravisual effects of SO2 emissions from fossil fuel electric generating stations on terrestrial vegetation.

APPROACH: Obtain low and high altitude color, color infrared, multi-spectral scanning, ground-truth, and spectral reflectance data.

PROGRESS: The above data is being obtained for effects on soybeans and mixed southern pine-deciduous hardwood timber stands in the vicinities of the Shawnee, Widows Creek, Johnsonville, and Colbert steam plants for both manual and automated interpretations, and (for spectral reflectance data) in the field and laboratory to calibrate the aerial sensors.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Office of Environmental Processes & Effects Research

5.0056, REMOTE SENSING FOR LAND RESOURCE MANAGEMENT WITH RANGELAND EMPHASIS

R.H. Haas, Texas A & M University, College Station Campus, Agricultural Experiment Station, Dept. of Range Science, *College Station, Texas* 77843 (0062471; TEX01978)

OBJECTIVE: Investigate the use of remote sensing for inventorying rangelands and other natural ecosystems for local and regional resource management. Evaluate the use of aircraft and spacecraft sensor data for monitoring the effects of weather and management on short-term range feed conditions and long-term successional changes in vegetation. Acquire basic information on reflectance characteristic of natural vegetation systems for cataloging phenological effects. Evaluate the cost-effectiveness of potential remote sensing applications.

APPROACH: Sequential, multispectral imagery will be obtained from rangelands with known management treatments. Existing and new aerial photography will be evaluated for observable differences in reflectance characteristics and compared with 'ground truth' data collected at selected sites. Terrestrial and aerial photography, as well as vegetation data and existing soils information will be used to evaluate satellite imagery for monitoring seasonal changes in vegetation conditions. Various types of remote sensing data will be evaluated as new information sources for practical application to the management of rangelands and other natural ecosystems.

PROGRESS: Research is being conducted on the use of remote sensing for inventorying rangelands and other natural ecosystems in Texas. Emphasis is given to evaluating the use of aircraft and spacecraft sensor data for monitoring the effects of management practices and weather conditions on short-term range feed conditions and long-term successional vegetation changes. A major effort is concentating on developing applications for large-scale color and color infrared aerial photography and LANDSAT data in managing University of Texas Lands in West Texas. A NASA supported study has been completed and indicates that of LANDSAT data products, the Transformed Vegetation Index (TVI-6) is an effective quantitative estimator of green biomass at critical seasons of the year. LANDSAT digital data analysis provide an effective tool for the regional monitoring of 'range readiness' and for monitoring seasonal and long-term drought on a regional basis. A study on the 'Evaluation of LANDSAT MSS data for classifying and characterizing natural vegetation on a regional basis' has determine that the most quantitative relationships between reflectance measurements and rangeland vegetation parameters occur in spring and fall. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Texas

5.0057, SEASAT PROGRAM - SOIL MOISTURE/SCATTEROMETER/SAR CORRELATION

R.J. Blanchard, Texas A & M University, College Station Campus, Texas Engineering Experiment Station, Remote Sensing Center, *College Station, Texas* 77843 (K7-975; MO-AO1-78-00-4332)

OBJECTIVE: To determine the range of the scattering coefficients (sigma o) received from SAR for all field conditions from dry to saturated and compare SAR AND 1.6 gHz scatterometer sigma o values over the same field conditions. The results are expected to aid in the evaluation of the SEASAT-SAR's sensitivity to differences in soil moisture.

APPROACH: In order to establish the influence of soil moisture on data collected by the SEASAT SAR, three major categories of data will be obtained: ground samples, aircraft 1.6 gHz scatterometer sigma o values, and digitized SAR imagery. Data analysis will be directed toward the following major considerations: 1. Is the influence of soil moisture differences a major factor in the interpretation of the SEASAT SAR imagery? 2. How well does the SAR data correlate to measured soil moisture differences? 3. How well does the SAR data correlate to scatterometer data?

CURRENT PLANS AND/OR PROGRESS: Complete negotiations and execute a contract by September 30, 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0058, REMOTE SENSING FOR IMPROVED SOIL AND CROP MANAGEMENT
H.W. Gausman, U.S. Dept. of Agriculture, Federal Research Office, Soil Water Conservation Research, *509 W. 4th St., Weslaco, Texas* 78596 (0043802; 7202-20762-002)

OBJECTIVE: Develop procedures for spectrally measuring plant stresses due to nutritional status, salinity, soil moisture, temperature, pollutants, drainage conditions, and soil edaphic factors on fruit, vegetable, and field crops and rangeland; apply remotely sensed plant and soil condition information to improve their management.

APPROACH: Thermal patterns will be sensed with scanners and radiation thermometers to develop freeze prediction equations, assess damage to sugarcane and other crops, develop cold protection systems and schedule irrigations. Color infrared photography and ground truth will be related to the health and yield of sugarcane, sorghum, citrus, and other crops. Laboratory and/or field spectral reflectance measurements, made periodically on normal and stressed crops and different crop genera, species, and cultivars, will be related to chlorophyll, water content, ground cover, and other factors to determine optimum wavelengths for detecting particular conditions and species' specific responses. Models describing the interaction of light with plant canopies and soils will be developed.

PROGRESS: A growth regulator (Pix - a registered trademark) increased near-infrared and decreased visible light reflectance of cotton leaves. Pix at 15 g a.i./ha increased the CO(2) assimilated by cotton leaves. Photo- and LANDSAT-estimated areas of silverleaf sunflower had good percentage agreements (9.1 and 9.5%, respectively). Leaf visible light reflectance of 5 of 7 rangeland species decreased as N concentration decreased. Optical constants (infinite reflectance, absorption coefficient, scattering coefficient were calculated for 7 weeds species. The shadow distribution pattern was different in plants with large, flat leaves oriented to intercept maximum amount of sunlight (sunflowers) from the pattern of narrow, curved leaves (corn and sorghum). A light absorption model (LAM) for vegetative canopies has been devised from the Suits' reflectance model. Wheat plant reflectances at the peaks (1.65 and 2.20 Mum) between water absorption bands differed more from the reflectance of bare soil early in the season and at maturity than did the other wavelengths. Reflectance in the near-infrared plateau (0.75 to 1.35 Mum) became the same as bare soil after the wheat lost its green color at maturity.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Subtropical Texas Area

5.0059, AGRICULTURAL APPLICATIONS OF SATELLITE ACQUIRED EARTH OBSERVATIONS
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OBJECTIVE: Develop and test rapid and timely methods for handling, analyzing, and applying satellite data to agricultural problems over large areas.

APPROACH: Relate satellite indicators of plant residue amount in a wheat-fallow rotation to wind and water erosion susceptibility of soils. Utilize earth surface temperatutes from NOAA-(SMS AND GOES) and NASA-(HCMM and LANDSAT C) to: Estimate soil temperatures suitable for planting advisories, determine vegetative ground cover, and estimate soil water conditions and/or evapotranspiration rates. Identify crops and land uses, measure crop acreages, and classify various soil and crop condition categories in the ARS wheat yield prediction effort and joint ARS-SCS wind erosion effort. Merge the spectral indicators of biomass, growing conditions, and stresses with physiological model outputs to improve estimates of grain (sorghum, wheat) maturity date and probable yields on the Great Plains. Inventory rangeland and estimate the harvestable forage. Investigate techniques for distinguishing plants and plant residues from the variable soil background that can aid automated soil mapping and crop discrimination.

PROGRESS: The hectarages of 5 land-use categories (grassland, mixed brush rangeland, saline rangeland, cropland, water) were successfully estimated using a LANDSAT color image enlarged to a 1:100,000 scale. A multitemporal classification strategy was developed and applied to a 1500-ha area. Atmospheric radiative transfer theory produced LANDSAT estimates of rangeland plant reflectances that are as accurate as those from the Exotech spectroradiometer. Wheat residue, necessary for soil erosion control, was significantly related to a soil brightness index derived from LANDSAT data at 5 sites near Akron, CO. Grain yields were significantly reduced when either 23, 43, or 63% of the leaf area was removed from the plant at half-bloom. A computer procedure was developed to scale rectify thermal satellite data to a 20-second-resolution rectangular coordinate map. Computerized techniques have been developed to extract satellite observed surface temperatures from each of 24 weather stations located in the HCMM test site and to provide surface temperature profiles from 48 areas that range from the Gulf of Mexico to 240 km inland. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Subtropical Texas Area

5.0060, GRANULE ARMOR ON SAND DUNES
R.S. Smith, University of Houston, School of Arts & Sciences, Dept. of Geology, *3801 Cullen Blvd., Houston, Texas* 77004 (NAGW 39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0061, ATMOSPHERIC DISTRIBUTION OF WATER VAPOR AND AEROSOLS BY WIND SYSTEMS AND TURBULENT FLUXES
G.L. Wooldridge, Utah Higher Education System, Utah State University, Agricultural Experiment Station, Dept. of Soil Science & Biometeorology, *Main Bldg., Room 104, Logan, Utah* 84321 (0062929; UTA00403)

OBJECTIVE: Measure airflow patterns in complex terrain. Calculate aerosol dispersion patterns. Prepare graphic representations of circulation features. Prepare profiles of water vapor and momentum fluxes in the atmosphere. Improve numerical models of dispersion in complex terrain. Continue the development of parameterization of vertical aerosol fluxes.

APPROACH: Airflow and aerosol dispersion patterns will be derived from pilot balloon, superpressure balloon, and tethered balloon flights tracked optically and carrying temperature transponders. The tracking data will be statistically analyzed to derive diffusivity coefficients. These (parametric) coefficients will be incorporated into one-, two-, and three-dimensional models of aerosol convection and dispersion. Temperature data will be analyzed to calculate heat fluxes in the lower atmosphere.

PROGRESS: Field investigations of air circulation patterns, dispersion parameters, and air temperature structure were completed over three mountain slope regions of Northern and Central Utah. The investigations used pilot balloons and superpressured mylar (constant volume) balloons carrying temperature transponders. The balloons were optically tracked over distances of several kilometers at progressively higher elevations up to altitudes of 2000 meters above the surface. The trajectories of the balloons have been traced on horizontal projections and related to the underlying terrain features. Vertical cross sections of the trajectories have been prepared, again with the underlying terrain shown; the temperatures telemetered from the sondes have been converted to potential temperatures and displayed along the trajectories. These in turn have been analyzed and are serving for calculations of atmospheric stability and potential energy. Diffusivity coefficients for different levels in the atmosphere have been calculated from the balloon tracking data. Most of the flights represent neutral or unstable atmospheric structure, and indicate the high capability of dispersion that exists on mountain slopes during periods of strong radiative warming. The diffusivity coefficients have been used to construct a one-dimensional model of coefficients as a function of atmospheric stability, surface roughness, and the geostrophic wind.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Utah

5.0062, HYDROLOGIC INTERPRETATIONS BASED ON HEAT-FLUX ANALYSES AND THE APPLICATION OF REMOTELY SENSED INFORMATION

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Aside from thermal loading stemming from powerplant operations, little has been done to assess man's influence on the thermal patterns of natural streams. Near stream environmental changes due to man's activities may adversely impact stream ecology by altering stream temperatures. In addition to stream-temperature problems, evaluation of remote sensing instrumentation as a method of detecting sources of thermal pollution, sedimentation, and erosion in large water bodies as well as current circulation has obvious application to a wide variety of hydrologic problems.

(A) to isolate and evaluate the effect of man-imposed changes on stream-temperature patterns; (B) identify stream-temperature patterns under a variety of climatic regimens; (C) to assess near shore current patterns in Lake Ontario using turbidity plumes as tracers; (D) to evaluate the utility of the LANDSAT III thermal imager as a means of detecting thermal plumes in the Lake; and (E) to continue work in defining the utility of remotely sensed land-use information as a means of improving streamflow estimates.

Pairs of watercourses consisting of a 'control' stream (one under essentially natural conditions) and one or more streams that have been altered by man's activities have been instrumented in selected basins of the northeast U.S. Comparisons on 'altered' stream and its control should reveal the effects of environmental changes on water-temperature patterns. High-altitude photographs and LANDSAT imagery will be used to detect transitory hydrologic phenomena such as heat and turbidity plumes, shoreline erosion, and ground-water inflow to streams.

Cooling water discharge at the rate of 30 m**3/s and flowing as a surface jet orthogonal to the shoreline produced a thermal plume in Lake Ontario that extended 1km offshore and was 2km in width in August 1978. The thermal plume created by the power plant located 19 miles northeast of Rochester, N.Y., changes shape rapidly in response to wind speed and direction. It is anticipated that the 10 degrees C rise in temperature above ambient lake levels created by the heated power plant discharge will be detectable by the HCMM satellite.

To continue field operations at the Ginna power plant for the purpose of detailing both thermal and turbidity plume dynamics under a variety of seasonal conditions. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0063, WATER RESOURCES DIVISION SATELLITE DATA RELAY PROJECT

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There is a rapidly developing satellite data transmission technology that may provide the Water Resources Division with an economical means for collecting and disseminating in real time data from remote sampling sites. Tests of the NASA LANDSAT and NOAH/NESS GOES data collection system have demonstrated the feasibility of mating USGS field instruments with field radios and routinely relaying the data. Yet to be determined are final specifications for an operational system, cost, benefits, and the feasibility of using a commercial service.

The objectives are to test and evaluate the performance characteristics of LANDSAT, GOES, Comsat General, and subsequently available satellite data systems as potential operational tools. The results of these test will be used to design and implement an operational satellite data telemetry system to support the collection of hydrologic data.

A number of LANDSAT DCS experiments have been conducted and will continue. The GOES-DCS was tested in 1976-77 and will continue to be tested through 1978. The Comsat General 11 site demonstrations ends June 19, 1978. A follow up on Comsat General pilot project involving 101 sites is expected to be tested in early 1979. This project will have overall responsibility for the program of testing these systems. The program will consist of technical coordination and direction from the project leader in Reston. Computer software support is being developed in the WRD Automatic Data Section.

LANDSAT and GOES are operational. The number of LANDSAT DCPs has decreased to 30. The GOES DCPs are slowly increasing and now stand at 110. The Comsat General 11 site demonstration has been successfully completed. The computer software development has been progressing with the assistance of contractor support.

LANDSAT and GOES DCS activities will continue to receive support from this project. WRD will be continuing to support changes in the GOES system so that DCP problems can be detected automatically and data can be sent directly from NESS to the USGS MULTICS computer in Reston. Plans are also being considered to test a hydrologic data service from a commercial source.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0064, PAST AND PRESENT SHORELINE TRENDS OF THE MID-ATLANTIC COAST AND WAVE ADVISORY SERVICES

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OBJECTIVES: Previous compilations of historical shoreline changes indicate large spatial and temporal variations in erosion and accretion even for areas only a few km apart. This proposed study will attempt to delineate this local variability by analysis of long-term beach profiles and data from aerial photography. Comparison of these data with historical data for the same areas will show if past shoreline trends are similar to present trends. An attempt to verify this comparison by delineating areas of greater vulnerability to storms will be performed with current storms. These data will be checked against weather forecaster's erosion reports, and comparison will then be made to past trends. Methodology will be developed for identifying areas of historical storm vulnerability, defining standard storms and using hindcasts for wave model input. In addition, assistance will be provided to J. Fisher (Clemson Univ.) and S. Nnaji (Univ. of Va.) in development of a comprehensive shoreline management model for the National Park Service and Wave Advisory Services will be provided to U.S. Army Corps of Engineers (Baltimore), State of Ohio, and others.

ANTICIPATED BENEFITS: These data, delineating areas of accreting and eroding shorelines, both presently and historically, will be extremely useful in planning the expanding use of the coastal zone. This information will be provided to all Federal, State and local planning and management agencies in the mid-Atlantic region. Attempts will be made to include these agencies as early as possible in order to obtain their advice on format of final product. An example of this usage is the comprehensive shoreline management model being developed by Fisher and Nnaji (based on these data) for the National Park Service to aid in their long-term management regarding the shoreline placement of buildings, parking lots, roads, etc. Knowledge of expected shoreline changes and their economic effect is considered by them to be essential for efficient management.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0065, POLAR ICE REMOTE SENSING

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 70-064)

One of the fastest varying large-scale features on the earth's surface is sea ice. Theoretical studies show that the ice canopy in polar regions to be of major importance in (1) determining the global heat balance, and (2) determining the vapor flux of water into temperate regions. In order to test the developing numerical models of polar regions it is necessary to acquire sequential large-scale synoptic data over polar regions. Remote sensing especially in frequencies in the microwave range, appear to offer the best change of obtaining these data.

As Principal Investigator for Sea Ice for NASA and the Space Craft Oceanography Center-NOAA, we will design polar remote sensing experiments using NASA and other agency remote sensing aircraft and satellites. Aircraft and satellite experiments will be coordinated with necessary ground truth net-

works for the remote sensing systems. The basic premise for these plans will be to develop the correct remote sensing means to acquire data that will be useful in testing numerical models of sea ice and glacier ice.

The Project Office will continue work on the AIDJEX data. The members will also participate in and direct the fall and spring NASA remote sensing flights for SEASAT and Nimbus-G experiments and will analyze data collected by the satellites, aircraft, surface experiments, and the Canadian surface and aircraft experiments. The work with GISS on sea ice models for global climate models will continue. We will also be working with the Conservation Division in Alaska on problems of offshore structures and ice and environmental hazards applications of the data. Dr. Campbell will continue his tenure on the glaciology panel and ad hoc committee on ice forces and offshore structures and a high level NASA committee for space applications.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0066, LONG TERM VIKING LANDER METEOROLOGY MISSION OPERATIONS AND ANALYSIS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0067, CHANNEL MORPHOLOGY AND SEDIMENTATION IN PHEASANT BRANCH NEAR MIDDLETON

W.R. Krug, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Madison, Wisconsin* (WI 77-084)

Severe channel and bank erosion in Pheasant Branch and accelerated sediment deposition in both Pheasant Branch Marsh and Lake Mendota are occurring within the basin. Accelerated degradation is occurring in the basin because channel was straightened in the 1930's for a drainage program and the basin is rapidly becoming urbanized. Bank erosion is encroaching on public and private property in the city of Middleton requiring expensive channel-protection measures. Lake deposition has become so severe as to require expensive routine dredging for aesthetic and navigational purposes.

The objective of the project is (1) to evaluate streamflow, sediment transport, and channel morphology in Pheasant Branch basin; (2) to relate these hydrologic charcteristics to land-use practices; (3) to provide a method of evaluating the effect that future changes in land-use practices will have on Pheasant Branch; and (4) to provide ground truth data for calibration of remote-sensing imagery as a tool in monitoring nonpoint pollution.

During the five-year project the following items will be completed for Pheasant Branch basin: (1) evaluate the headwater erosion and stream-channel morphology; (2) analyze effects of urbanization on stream-channel morphology, sediment transport, and delta formations; (3) project changes in channel geometry, streamflow, and sediment transport; (4) delineate between stream-channel and upland erosion; (5) identify critical areas of erosion and suggest required management practices; and (6) supply cooperator with sediment transport, streamflow, sediment-source, and channel-geometry data for remote-sensing imagery calibration.

Compared 1971 and 1977 channel surveys. Surveyed additional cross-sections at sites throughout basin. Installed additional recording rain gage at western edge of basin.

Continue monitoring streamflow and sediment at gaging stations. Resurvey 1977 channel cross-sections. Calibrate Middleton storm-water management model and use for various development conditions. Do bed material survey.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0068, REMOTE SENSING OF THE GREEN BAY WATERSHED TO ESTIMATE THE IMPACT OF LAND DEVELOPMENT ON THE BAY'S WATER QUALITY

F. Scarpace, University of Wisconsin, Madison Campus, Inst. for Environmental Studies, *Agriculture Hall, Madison, Wisconsin* 53706 (R/GB-9)

OBJECTIVE: To use remote sensing data in a hydrological runoff model to assess nonpoint source pollution in Green Bay and to predict the effects of future land development on the Bay's water quality. Specifically: 1. To develop techniques for mapping land cover from digitized multispectral aerial imagery for use in a hydrological runoff model. 2. To demonstrate the viability of the above technique in selected Green Bay watershed areas. 3. To utilize the resultant data in: a) an existing Wisconsin Department of Natural Resources model for use in the 208 Water Quality Program and, b) several streamflow-water quality models developed by the U.S. Geological Survey.

ANTICIPATED BENEFITS: This information will be of direct benefit to state and local agencies managing the Green Bay area as well as other Sea Grant investigators studying the nonpoint source pollution problem in Green Bay (see R/GB-8). Both the Wisconsin Department of Natural Resources and the U.S. Geological Survey will cooperate on the project and, if it is successful, will probably apply the techniques to their other ongoing programs. These techniques should have nationwide application in studies of the contribution of land use and development to water quality degradation.

IDENTIFIED BENEFITS TO DATE: 1. Contact has been established with the city of Green Bay's Engineering Department, Brown County Highway Commission and local representatives of the Wisconsin DNR. 2. Selected three diverse subwatersheds in the Green Bay area as test sites and established monitoring stations on all three sites. These will become operational by mid-March. 3. Preliminary photointerpretation of existing imagery of the sites was carried out.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0069, INTERPRETATION OF RESULTS FROM THE PIONEER VENUS NET RADIOMETER EXPERIMENT

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0070, PRECIPITATION RATES FROM WAVE AND INFRARED RADIOMETRY AND USE OF SEASAT-A DATA TO DETERMINE HURRICANE PRECIPITATION (ABBREV)

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (7-924; MO-AO1-78-00-4320)

OBJECTIVE: SEASAT-A SMMR data will be used to demonstrate the remote determination of rainfall rates by microwave radiometry. The proposed study will build upon experience gained in the analysis of NIMBUS-5 ESMR data, and an important objectve will be to utilize the SMMR data to monitor rainbands in hurricanes during the course of their evolution.

APPROACH: Develop rainfall analysis procedures taking advantage of SMMR multispectral microwave imagery supplemented mainly by infrared experience. Obtain ground truth from digitized radars, such as in the D-Radex and those in operational NWS networks which provide VIP displays. Raingage network data will be obtained for ground truth to check the rainfall rates inferred from SEASAT-A observations. Rainfall distributions from SEASAT-A will be tracked as hurricanes develop and travel westward across the Atlantic Ocean. The analysis will be extended to include the effects of capillary waves and foam.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0071, CARBONYL SULFIDE - AN ANALYSIS OF MEASUREMENT TECHNIQUES AND DETERMINATION OF THE STRATOSPHERIC PROFILE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, LIVER CELLS - A MODEL SYSTEM FOR STUDIES ON METABOLISM IN SPACE

M.E. Tolbert, Tuskegee Inst., School of Arts & Sciences, Dept. of Biology, *Tuskegee Institute, Alabama* 36088 (NAG 2-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, MODULAR AUTOMATED ENZYME ACTIVITY ANALYZER SYSTEM

J. Fox, Caltronics Industries Inc., *Solana Beach, California* 92075 (DF324370; F33615-78-C-0625)

To develop a fully automated modular system with operator controlled multi-variable parameters for assay of intracellular enzyme activity. This system will be used to develop methods that provide additional diagnostic tools in the detection and treatment of incipient disease. These methods will directly support the USAF Aeromedical Consultation Service and the heart program for determining risk, and will also provide additional criteria for screening enlistees for the Air Force.

A multi-source solicitation will be sent to civilian companies for the design, fabrication and delivery of a modular system. Cost-effective design will incorporate 3 detector components presently in use in the clinical pathology branch for the measurement of optical density, fluorescence and luminescence. The modules to be fabricated are: sampler, flow cell, flow cell filter, analong-to-digital interface, and microprocessor. The purchase request package has been submitted and we are awaiting receipt of proposals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0003, INSULIN RESISTANCE IN ANIMALS EXPOSED TO WEIGHTLESSNESS IN SPACEFLIGHT - EFFECT OF EXERCISE TRAINING

G.M. Reaven, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NAS 2-10512)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, MONKEY METABOLISM, BODY COMPOSITION AND CARDIOVASCULAR FUNCTION IN WEIGHTLESSNESS, EXPERIMENT NO. 781-061

N. Pace, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physiology & Anatomy, *Berkeley, California* 94720 (NAS 2-10499)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, SCALE RELATIONSHIPS IN MAMMALIAN METABOLISM IN WEIGHTLESSNESS, EXPERIMENT NO. 781-310

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, LIFE SCIENCE EXPERIMENT ARC 781-127, EFFECT OF ZERO-GRAVITY ON BIOCHEMICAL AND METABOLIC PROPERTIES OF SKELETAL MUSCLE

K.M. Baldwin, University of California, Irvine Campus, California College of Medicine, Dept. of Physiology, *Irvine, California* 92664 (NAS 2-10522)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, EVOKED RESPONSE MEASURES OF RESOURCE ALLOCATION - EFFECTS OF PRIMARY TASK LOADS

L.F. Elfner, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Psychology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DF055090; AFOSR-79-0097)

AF function - as part of a workload measurement research plan of the Air Force, it is necessary to develop, test, and apply a standard technology for predicting and evaluating crew performance with implications for equipment design and work allocation. Deficiency -designers do not yet have at their disposal standard methodologies which allow them to answer crucial operational questions such as optimum crew composition, optimum distribution of tasks, duties, and responsibilities to crew members, and optimum allocation of functions and tasks to the person, machine, and computer. Objective - the proposed research will extend previous studies of allocation of information processing resources under various stressful workloads which relate to airborne piloting tasks. How research contributes - the primary and secondary tasks to be studied in a proposed workload paradigm will closely simulate the control and monitoring task of a pilot. The study of sequence effects within a given a priori probability in a proposed uncertainty task should allow for the parametric study of resource allocation in the workload paradigm and thereby contribute to the goal of establishing a standardized methodology for workload measurement.

The research will assess the utility of employing event related potentials (ERP) in a procedure that simulates the control and monitoring tasks of a pilot. The amplitudes of the P-3 component of the ERP, which is known to reflect active processing of information, will be measured to provide an index of the resource demands of the flight simulation task. Critical testing will be made of the hypothesis that as primary task difficulty increases there will be a decrease in the amplitude of the P-3, that is, there will be lesser amounts of information processing on the secondary task when greater resource demands are placed on the primary flight simulation task. A primary task to be defined at a reasonable level of difficulty will be performed in a link trainer, and the evoked responses to target stimuli will be the dependent measure on a secondary task. Also, an experimental study of the effect of random versus fixed inter-stimulus intervals in an uncertainty task will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, LIFE SCIENCE EXPERIMENT - CELL-TO-CELL COMMUNICATIONS IN SPACE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, CARDIOVASCULAR ADAPTATION OF WHITE RATS TO DECREASED GRAVITY OF SPACE SHUTTLE/SPACELAB INFLIGHT CONDITIONS, EXPERIMENT ARC 781-248

V.P. Popovic, Emory University, School of Medicine, Dept. of Physiology, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (NAS 2-10527)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, THE ROLE OF GRAVITY PERCEPTION IN THE ESTABLISHMENT OF THE DORSAL VENTRAL AXIS OF THE AMPHIBIAN EGG

G.M. Malacinski, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Zoology, *Memorial Hall, Bloomington, Indiana* 47401 (NAGW 60)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0011, LIFE SCIENCES FLIGHT EXPERIMENT - RENAL & MUSCULO-SKELETAL RESPONSES TO WEIGHTLESSNESS AND READAPTATION TO NORMAL GRAVITATION FORCES IN RATS

X.J. Musacchia, University of Louisville, School of Arts & Sciences, Dept. of Biology, *129 E. Broadway, Louisville, Kentucky* 40202 (NAS 2-10510)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, MECHANICAL STRESS ON SOFT TISSUE MATERIAL PROPERTIES

R.W. Little, Michigan State University, School of Osteopathic Medicine, Dept. of Biomechanics, *Soil Science Bldg., East Lansing, Michigan* 48824 (DF325050; F33615-79-C-0514)

To investigate the tensile strength characteristics of the soft tissues of the musculoskeletal system, particularly the ligaments responsive to spinal loading; to determine the effects of biological prestress, vibration and aging on soft tissue material properties; and to develop data for a biomechanical model to test the effects of mechanical forces on the ligamentous apparatus of the spine and appendicular joints leading to the establishment of human exposure limits and development of protective measures for aircrew personnel.

A three-year multiphase investigation will be undertaken using mainly nonhuman primates as subjects. The first phase will determine the material property characteristics of the ligamentous apparatus of the body as a function of various amounts of deformation and strain rates; then identify the flexor and extensor muscle groups and compare their strength characteristics in rhesus monkey, baboon, chimpanzee and man. the second phase will involve in-depth study of the prestress state of ligaments, tendons, etc., and include quantitative measurement of prestress in these tissues, role of prestress to soft tissue loading response, and effect on prestress of vibrational forces. The third phase will identify the fatigue characteristics of ligaments, tendons and muscles under cyclic loading. Scanning electron microscopic studies will be used to identify morphologic changes. The last phase will be concerned with the development of quantitative relationships characterizing observed soft tissue material properties and incorporating observed mechanisms and levels of failure. This analytic formulation shall allow extrapolation of results to provide predictions of response and injury in mechanical stress environments and lead to the establishment or refinement of biodynamic exposure limits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, INVESTIGATION OF THE NEGATIVE GEOTROPIC RESPONSE IN GEOSENSITIVE PULVINI OF THE OAT PLANT (AVENA SATIVA)

P.B. Kaufman, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Biological Sciences, *Ann Arbor, Michigan* 48104 (NAGW 34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0014, A GROUND-BASED COMPARATIVE STUDY OF THE EFFECTS OF WEIGHTLESSNESS ON THE DEVELOPMENT OF AMPHIBIAN EGGS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0015, NEW DESIGN CONCEPTS FOR O2 DELIVERY TO AIRCREW

R. Beale, Fluid Power Controls, *St. Paul, Minnesota* (DF325620; F33615-79-C-0618)

Adequate delivery of breathing oxygen to aircrew members is limited by functional performance characteristics of the hardware design of oxygen delivery components in current use. Crew members of high performance aircraft in particular require breathing gas to be delivered within narrower limits with respect to oxygen concentration, and over a wider range with respect to inspiratory rate of flow, than current hardware allows. This effort will explore new design concepts for the delivery of breathing gas which meet those requirements and which have high potential for practical application in flight.

Hardware design concepts to include microelectronic and pneumatic control systems will be simulated and quantitatively analyzed with respect to functional performance characteristics which satisfy both physiological requirements and limitations of the operational environment. Major consideration will be given to high system reliability and low production cost in the design of potential production models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, INVESTIGATION ON THE EFFECTS OF HYPOGRAVITY ON SOME CRITICAL CELLULAR EVENTS IN PLANT DEVELOPMENT

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, LIFE SCIENCE EXPERIMENT ARC 781-127, CORRELATION OF MACRO- AND MICROCIRCULATORY ALTERATIONS DURING WEIGHTLESSNESS

P.M. Hutchins, Wake Forest University, School of Arts & Sciences, Dept. of Biology, *Reynolda Station, Winston Salem, North Carolina* 27109 (NAS 2-10523)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0018, THE MECHANICS OF LONG BONE FRACTURES

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AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces which included flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Despite design improvements on ejection seats, dislodging of the limbs occur frequently when the body is ejected into the windblast. The resulting 'flail injuries' are the dislocation of major articulating joints and various long bone injuries. Deficiency - this research effort will investigate the mechanics of long bone fractures. Studies relevant to the fracture mechanisms of whole bone tissue under combined states of loading and at high loading rates have not been reported in the literature. Objective - this research program will elucidate the configuration of fracture patterns, conduct a fracture site analysis, qualify loading rate effects, investigate predictive analytical models for long bones and define the association of the operational environment and the magnitudes of loading states occur-

ring therein. How research contributes - this effort directly supports RO 1.7.1, 'Criteria for Limb Flail Injury Prevention.'

This effort will be conducted by the following approaches: (a) Determine fracture pattern definition of long bones under singular and combined states of loading, including tension, compression, torsion and bending modes. (b) Develop long bone fracture site analysis. (c) Determine the effects of loading rates on resistance and energy absorption to fracture under combined states of loading. (d) Identify the effects of impact loading on long bones. (e) Formulate mathematical models to predict the behavior of long bones under singular and combined loading states. (f) Evaluate comparatively the effectiveness of methods of internal fixation in preventing refracture by a similar loading mechanism. (g) Define the operational environment in which singular and combined states and rates of loading to upper and lower extremity long bones exist, so as to insure the relevance of the laboratory investigations to that environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0019, MICROBIAL ECOLOGY OF EXTREME ENVIRONMENTS - ANTARCTIC DRY VALLEY YEASTS AND GROWTH IN SUBSTRATE-LIMITED HABITATS

H.S. Vishniac, Oklahoma State University, School of Arts & Sciences, Dept. of Microbiology & Medical Technology, *Agricultural Hall, Stillwater, Oklahoma* 74075 (NAGW 26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0020, MECHANISM(S) UNDERLYING FLUID VOLUME SHIFTS IN ZERO GRAVITY (EXPERIMENT ARC 781-207)

H.L. Stone, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 2-10526)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0021, LIFE SCIENCE EXPERIMENT ARC 781-285, ANGIOTENSIN RELATED CHANGES IN BODY HYDRATION

W.B. Severs, Pennsylvania State University, Milton S. Hershey Medical Center, School of Medicine, Dept. of Pharmacology, *500 University Dr., Hershey, Pennsylvania* 17033 (NAS 2-10521)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0022, REGULATION OF ERYTHROPOIESIS IN MICE DURING SPACEFLIGHT, EXPERIMENTS ARC 781-011, 781-012

C.D. Dunn, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Biology, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 2-10528)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0023, LIFE SCIENCE EXPERIMENT, ARC 781-288, ADAPTIVE CHARACTERISTICS OF ENZYMES OF NITROGEN METABOLISM IN MAMMALS DURING SPACEFLIGHT

J.W. Campbell, Rice University, School of Natural Sciences, Dept. of Biology, *6100 Main, Houston, Texas* 77001 (NAS 2-10519)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0024, MEASUREMENT OF RFR TEMPERATURE DISTRIBUTIONS IN BIOLOGICAL STRUCTURES

J.C. Burr, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320730)

Air Force personnel are required to work in environments which may require exposure to radiofrequency radiation (RFR) on an intermittent or periodic basis. This energy may be produced by a variety of emitters whose characteristics vary in frequency and mode. An extensive biotechnology base is necessary to assure continued maximum safety while allowing essential mission operations.

It is not feasible to experimentally quantify every combination of frequency, exposure duration, pulse characteristic, etc., which may be encountered. Theoretical calculations and computer modeling can provide an expedient means for hazard estimation when based on sound experimental data. Existing models which predict power distribution patterns in the head will be tested experimentally utilizing phantoms, cadavers, and specially implanted experimental animals. Predicted values from the model will be compared to in vivo measurements with subsequent refinement of model inputs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, STATISTICAL TOOLS FOR FITNESS-TO-FLY-DETERMINATION

P.L. Brockett, University of Texas, Austin Campus, Graduate School, *200 W. 21st, Austin, Texas* 78712 (DF324330; F33615-78-C-0623)

Coronary artery disease (CAD) is a major cause of ineffective time and disability retirement in the Air Force, and has been implicated in aircraft accidents. Thus, early diagnosis and prevention of CAD in aircrew members is of importance to the Air Force. Several clinical factors (serum cholesterol levels, blood pressure, ECG changes, etc.) are known to be associated with an incresed risk of CAD in human subjects. This workunit focuses on the development of mathematical equations which numerically relate risk factors to the occurrence of CAD in flying personnel such that these equations can actually be used in early disease diagnosis and prevention at significant cost savings to the Air Force.

There are at least three different types of information that can be looked for in a flyer's medical history- 1. A possible trend over time that indicates greater and greater risk of failure compared to the risk of the general population, 2. A stable abnormality that can be verified by repeated observation of a minor shift away from the population norm, and 3. A recent change compared to an individual's prior stable condition that corresponds to changes suggesting increased risk of failure. As a first step to incorporating these three features into a single probability estimate, the Cox proportional hazard model will be generalized to a log-linear model based on trend measures, location parameters and recent shock indicators that are orthogonal in form. A second approach reduces the dimensionality of the problem by using time series analysis to predict the future state of the individual's signs. Then the usual 'snapshot' techniques such as Cox's model or discriminant analysis can be used on this 'virtual' observation to establish the probability of failure and the effect of each covariate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, THE EFFECT OF STRESS ON HUMAN BLOOD PLATELETS

J.N. George, University of Texas, Health Science Center at San Antonio, South Texas Medical School, Dept. of Medicine, *7703 Floyd Curl Dr., San Antonio, Texas* 78284 (NAG 9-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0027, INFLUENCE OF SPACEFLIGHT ON CYTOGENETICS AND MUTAGENICITY

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0028, CENTRAL OTOLITHIC MECHANISMS IN NON-HUMAN PRIMATES
A.A. Perachio, University of Texas, Medical Branch at Galveston, Graduate School, *Galveston, Texas* 77550 (NAG 2-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0029, ANATOMICAL AND ELECTROPHYSIOLOGICAL STUDIES OF THE EFFECTS OF WEIGHTLESSNESS ON THE VESTIBULAR APPARATUS OF THE GERBIL
M.J. Correia, University of Texas, Medical Branch at Galveston, School of Medicine, Dept. of Otolaryngology, *300 University Blvd., Galveston, Texas* 77550 (NAS 2-10502)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0030, NAVY ENVIRONMENT - NEUROPATHOLOGY OF CENTRAL NERVOUS SYSTEM FOLLOWING IMPACT INJURY
F.J. Unterharnscheidt, Rehabilitationsklinik Loipl, *Bischofswiesen, Berchtesgaden, Federal Republic of Germany* (DN875545; N00014-78-C-0800)

The Naval Aerospace Medical Research Laboratory Detachment, New Orleans (NAMRL/DET) is conducting experiments to determine human dynamic response to impact acceleration as part of an aircraft impact injury prevention program. This work unit is concerned with a study of the effects of impact-acceleration on the nervous system.

This research will be performed in conjunction with the U.S. Navy research effort. Experimental procedures will be performed at NAMRL/D. Neuropathological tissue will be sent to the Rehabilitationsklinik Loipl. The contractor will be responsible for the preparation of micro-and macropathological examination of these specimens.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS BY THE METHOD OF LINES
B.H. Edwards, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Mathematics, *208 Tigert Hall, Gainesville, Florida* 32601 (NAG 1-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0002, RESEARCH IN NUMERICAL ALGORITHMS FOR THE FINITE ELEMENT MACHINE
W.E. McBride, Western Illinois University, School of Arts & Sciences, Dept. of Mathematics, *900 W. Adams St., Macomb, Illinois* 61455 (NAG 1-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0003, A TENSOR-PRODUCT FINITE ELEMENT ALGORITHM FOR NAVIER-STOKES SOLUTIONS AT LARGE REYNOLDS NUMBERS
A.J. Baker, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Mathematics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAG 1-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0004, A RETARGETABLE PATH PASCAL SYSTEM FOR IMPLEMENTATION ON CONCURRENT PROGRAMS ON 16-BIT MICROCOMPUTERS
R.F. Mathis, Old Dominion University, School of Sciences & Health Professions, Dept. of Computer Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXTINCTION OF LASER RADIATION BY SMALL PARTICLES
D.R. Huffman, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DN790029; N00019-77-C-0293)

The objective is to study absorption and scattering of laser radiation in the 10 micron spectral region as a countermeasure to the effects of such radiation.

A combination of related theoretical and experimental studies are proposed to help determine the most efficient method for extinction of CO2 laser radiation by small particles. The two major systems are (1) very small silicate particles where absorption dominates, and (2) hollow glass spheres, where scattering is expected to dominate.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

8.0002, RENEWED SYNOPTIC OBSERVATIONS AND RESEARCH ON BASIC PROPERTIES OF THE SOLAR CYCLE
S.F. Martin, California State University & Colleges, California State University, Northridge Campus, School of Science & Mathematics, Dept. of Physics, *18111 Nordhoff St., Northridge, California* 91324 (NAGW 27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0003, THEORY OF INTERACTION EFFECTS IN TRANSPARENT MATERIALS EXPOSED TO INTENSE INFRARED RADIATION
M. Sparks, Pacific Sierra Research Corp., *Santa Monica, California* 90404 (DF054850; F49620-79-C-0061)

AF function - high energy laser technology is finding wide application in future Air Force systems. Opportunity - both in the production of intense radiation and in the hardening of certain critical components to this radiation, the interactions of photons with matter is of extreme importance. Electrical breakdown in solids is an important basic problem because it is one of the simplest properties of solids that is not understood, and it is an important practical problem because optical and electrical breakdown limits the operation of so many electrical and optical devices. Objective - the general purpose of this research is to solve the fundamental problems of the interactions of infrared radiation with matter. More specifically, the objective is to establish a tenable theory of high-power laser damage to semiconductor and optical materials, and to compare the electron-avalanche breakdown process in dielectric materials with such other breakdown processes as multiphonon, tunneling, Raman, Brillouin, self-focusing, macroscopic-inclusion, and microscopic cluster-inclusion damage processes in order to determine under what conditions the electron-avalanche process dominates. The emphasis will be on infrared damage to semiconductor andoptical materials. How work contributes - there is a high probability of solving the problem of explaining and predicting optical and electrical breakdown in solids. The impact of a successful theory would be two-fold. It would make a significant contribution to the theory of solids and it would be of practical importance to the operation and performance of high power semiconductor and optical devices and allow the predetermination of

whether window materials can be improved to increase their high-power laser damage threshold.

The approach to the solution of the electron-avalanche-breakdown problem will be first to describe a transport theory that incorporates such physical processes as the large-quantum processes - the photon-electron-phonon process, in which an electron is accelerated with the accompanying annihilation of a photon and the creation of annihilation of a phonon, and inter-conduction-band transitions - in addition to such previously considered processes as the Seitz luck-electron process. Specific steps include checking the preliminary transport equation that does not include large-quantum processes solving the equation for a few selected cases. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0004, MAGNETOSPHERIC PLASMA PHYSICS

C.F. Kennel, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM78-19958)

This research program concerns the dynamics of the magnetic field of the earth and its interaction with particles and fields from the sun. The major aims are: (1) to understand magnetic reconnection, to integrate it into magnetospheric theories, and - something of general significance - to understand the acceleration of energetic particles in reconnection events; (2) to understand the global response of the magnetosphere to time-dependent events in the solar wind; and (3) to understand the role of plasma turbulence in the earth's magnetosphere, with a special emphasis on electrostatic waves.

The effort supported here will be theoretical in nature and will be performed by a team of researchers from the Departments of Physics, Astronomy, Geophysics and Atmospheric Sciences at the University of California, Los Angeles.

The overall aim of the work is to use plasma theory to increase our knowledge of magnetospheric dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0005, ROTATIONAL COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) APPLICATIONS

R.K. Chang, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (NAG 1-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0006, MOSSBAUER STUDIES OF TERNARY SUPERCONDUCTORS

C.W. Kimball, Northern Illinois University, School of Liberal Arts & Sciences, Dept. of Physics, *DeKalb, Illinois* 60115 (DMR78-09773)

This is a continuation of research sponsored under grant DMR7618371.

Many strong coupled superconductors have anomalous phonon properties. The physical basis of these unusual phonon properties, such as mode softening and anharmonic effects, which correlate with high transition temperatures, Tc's, is of importance to the understanding of the interactions responsible for high Tc's. The principal thrust of this research is a systematic study of lattice and electronic properties of high Tc ternary compounds, e.g. Chervel phases and A15 intermetallic compounds, by means of the Mossbauer effect. Correlation of these data with the results of other physical measurements will aid in clarifying the role of phonon spectra in the enhancement of Tc.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, MATERIAL PROPERTIES AND PHENOMENA AT VERY LOW TEMPERATURES

J.R. Ketterson, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (DMR78-11771)

This is a continuation of work sponsored under DMR-7621370. An experimental study will be made of the properties of helium-3 and nuclear ordering in solid helium-3. A nuclear cooling cryostat will be constructed and longitudinal and transverse sound characteristics will be studied in superfluid helium-3. The magnetic properties of solid helium-3 will be examined. Sound propagation studies of liquid crystals will be continued. Transition metals will be examined at ultra-low temperatures for the existence of superconductivity. This work is important for understanding quantum solids and fluids and the low-temperature behavior of metals and liquid crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, MAGNETISM IN TRANSITION-METAL ALLOYS AND RARE-EARTH COMPOUNDS

J.S. Kouvel, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Physics, *601 S. Morgan St., Chicago, Illinois* 60680 (DMR78-12777)

This is a continuation of research previously supported under DMR-7622305.

In studies of magnetic materials, one of the areas of current interest is the determination of the critical concentration of magnetic atoms, needed for the system to become magnetically ordered. In this project, specific heat measurements will be carried out in high magnetic fields in order to study and characterize local magnetic effects (magnetic clusters, paramagnons) in alloys such as Pd-Ni and Ni-Cu near their critical compositions for ferromagnetism. Similar measurements will be carried out to determine the local exchange and anisotropy fields in mictomagnetic alloys such as Cu-Mn. A further experimental study of higher order (biquadratic) exchange interactions in single crystals of selected rare-earth compounds, such as HoSB and PrAg, will be carried out.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, THEORETICAL AND LIDAR STUDIES OF DYNAMICAL INFLUENCES IN THE ATMOSPHERIC SODIUM LAYER

C.F. Sechrist, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (ATM78-12308)

Since the 1930's we have known of the presence of significant concentrations of sodium in the upper atmosphere near mesospheric altitudes. Questions remain as to sodium sources and sinks. Recently, improvements in dye lasers have made ground based time continuous altitude profiles practicable for sodium near the 80-100 km altitude range. Much enthusiasm is mounting over the potential of such data in the sodium transport dominated region, to trace dynamical features through this difficult to diagnose altitude region.

This grant funds operation of the Urbana sodium lidar. Research under this grant will include: theoretical studies of the sodium layer detailed structure, using a computer model; use of signal processing techniques to enhance the sodium-layer profile data; laser system improvements; receiver system improvements; and correlative measurements involving near simultaneous meteor-radar winds and sodium lidar experiments, in order to study the influence of neutral atmospheric wave motions on sodium layer structure.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0010, COLLISIONAL INTENSITY AND BROADENING EFFECTS ON ATOMIC SPECTRAL LINES
J.F. Kelkopf, University of Louisville, School of Arts & Sciences, Dept. of Physics, *129 E. Broadway, Louisville, Kentucky* 40202 (PHY78-18862)

This project in atomic physics will study the broadening and modification of intensity of atomic spectral lines by neutral atom collisions. In particular, collision-induced transitions involving highly excited states will be measured. This will lead to an experimental determination of interatomic potentials for the interaction of excited atoms and neutral unexcited perturbers, and will afford a comparison with theoretical predictions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, PLASMA HEATING, LIGHT SCATTERING AND SPECTROSCOPY
H.R. Griem, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY78-00973)

Research will continue, directed on various problems in plasma turbulence and in thermal fluctuations of dense equilibrium plasmas, with special emphasis on diagnostics. These problems are of a basic nature and have a number of applications to other fields, ranging from astronomy to magnetic and inertial fusion research.

This work represents a continuation of that currently supported by Foundation grant PHY76-24454.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0012, SOLID-STATE PHYSICS STUDIES WITH POSITRONS
S. Berko, Brandeis University, School of Arts & Sciences, Dept. of Physics, *415 South St., Waltham, Massachusetts* 02154 (DMR76-24376 A01)

Solid-state physics research using positron annihilation techniques previously supported by NSF grant DMR73-02563 A03 will be continued. The research program consists of two projects: a) electronic momentum density measurements using a newly built 64 counter two-dimensional angular correlation apparatus, and b) slow positron interaction studies with solid surfaces. Under project a) the Fermi surfaces and the electronic band structure of disordered as well as of some ordered alloys, and the electronic momentum densities in ferromagnetic metals will be investigated. In the slow positron beam experiments (project b), an ultrahigh vacuum system will be built to allow the study of well-specified surfaces. The formation of positronium by slow positrons at metal surfaces, the physics of positron work-function and positron emission from solid surfaces, as well as slow positron scattering will be studied experimentally. The parameters of the electronic dipole barrier at metal surfaces will be determined from these experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, CORONAL PLASMA PROCESSES - HEATING AND ENERGETIC BALANCE OF CLOSED CORONAL STRUCTURES
G.S. Vaiana, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAGW 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0014, ELECTRON ENERGY LOSS SPECTROSCOPY OF GALLIUM ARSENIDE AND OTHER MATERIALS
M. Weiler, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF056110; F49620-79-C-0176)

AF function - advances in command, control and communications depends directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon the solid state electromagnetic materials of special and unique properties and behavior. Opportunity - electron energy loss spectroscopy (ELS) provide a timely opportunity to develop technique for mapping the conduction band structure of crystalline materials to gain new insight into the nature of localized electronics, excitations, and to probe the nature of charge transfer in intercalated compounds and the formation of interface states, and to gain the knowledge needed to realize the potential of ELS as a powerful analytical tool for submicron structures. Objective - to significantly advance the scientific understanding of electronic processes in condensed matter. To provide experimental information which relates specific features of the electronic band structure to their locations in the Brillouin zone and thereby understand such phenomena as hot-electron behavior and charge density waves. How work contributes - GaAs is used to construct many devices, such as FET's avalanche diodes, and Gunn oscillators, whose operation depends on or is limited by electrons in the secondary conduction band minima. A knowledge of the Brillouin zone location, energy and curvatures at these minima, and at the immediate maxima, as well as the gaps at the maxima to the next higher conduction bands, should have a major impact on future development of these devices as well as for GaAs quaternary compounds.

Construct a new electronic energy loss spectrometer which will have the capability of measuring electronic excitations in thin bulk samples at high resolution over a wide range of energy loss and momentum transfer. Study interband transitions in GaAs for momentum transfer along different crystalline directions. Map the dispersion of the conduction band and to locate the energies and positions in the Brillouin zone of the secondary conduction band minima. Study the momentum-dependence of the intensity of single-particle and collective energy losses which provides information on the structure and degree of localization of the electronic states in crystalline and amorphous materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0015, HIGHLY EXCITED ATOMS
D. Kleppner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF034500; F44620-72-C-0057)

AF function - this research effort is concerned with the investigation of very high lying atomic levels. These states of are great interest because of their large polarizabilities and stark shifts, low ionization potentials and large dimensions. This study of highly excited atoms can lead to new techniques for detecting millimeter and infrared radiation for application to communications and plasma diagnostics, for example. Opportunity - this study of single highly excited atomic states presents opportunities for studying a variety of phenomena involving atoms and radiation, including: photoionization processes, tunneling phenomena in static and oscillating fields, and resonance phenomena. It also permits the study of collision in highly excited species and of level crossing dynamics which are important in many inelastic atomic and molecular collisions. Objective - the goal of this effort is to complete the study of field ionization in alkali one-electron systems, and to investigate field ionization in hydrogen. Contribution - work on highly excited atoms is a very active field. The process of tunneling in an electric field of a one-electron atom has been observed in detail and the measured rates were found to be in serious disagreement with hydrogenic theory. The continuing effort will investigate tunneling in alkalies, particularly on effects of level mixing. Other work will include experiments on the Landau-Zever effect, and the creation of Rydberg states of hydrogen, and a theoretical study of tunneling in alkalies.

The study of field ionization of sodium has shown that the theory developed for hydrogen is totally inadequate to deal with most levels of other one-electron atoms. A comprehensive theory for field ionization of a one-electron system in a non-Coulombic system is needed and will be pursued in this effort. In parallel with this, the experimental investigation of field ionization rates will be extended. Ionization rates for Rydberg states of hydrogen will be measured. Fine structure effects break

the exact symmetry of the non-relativistic model and lead to level mixing effects which may play a major role in the ionization process. Many inelastic collision processes in diatomic molecular processes are explained simply in terms of non-adiabatic transitions at level anticrossings, caused by the relative motion of the atoms. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0016, ELECTRONIC PROPERTIES OF METALS, SEMI-METALS, AND ALLOYS DOWN TO ULTRALOW TEMPERATURES

P.A. Schroeder, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (DMR78-07892)

This is a continuation of the research program on electron transport properties of metals, alloys and semiconductors previously supported by NSF grant DMR-7501584 A02. While some measurements will be done over a wide temperature range, the main thrust will be in the ultralow temperature region, extending the present low temperature limit of approximately 30mK for resistivity measurements down to approximately 5mK. The other main thrust will be to extend measurements in high magnetic fields from the 1-4K region to the region of approximately 100mK. Also, a precision current comparator will be used in an attempt to reach a precision of 1 in 10 to the 7th power in resistivity measurements. This will permit definitive studies of the controversial temperature-dependent resistivities of the alkali and noble metals and of deviations from Matthiessen's role in aluminum and silver based alloys. Work on thermoelectric effects in noble and alkali metals and in tungsten, palladium and platinum will continue in order to identify processes for ultralow temperature anomalies occurring in several of these. New areas of investigation include: the effect of the crystal electric field and hyperfine coupling on transport behavior; transport properties of amorphous metals and alloys; and electrical response of algae cells.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, A PHOTOIONIZATION MASS SPECTROMETER STUDY OF CARBON VAPOR

G.H. Rayborn, University of Southern Mississippi, School of Science & Technology, Dept. of Physics, *Hattiesburg, Mississippi* 39401 (NAG 1-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0018, HIGH-FIELD NUCLEAR ACOUSTIC RESONANCE STUDIES OF SINGLE-CRYSTAL METALS, INSULATORS, AND SEMICONDUCTORS

R.K. Sundfors, Washington University, School of Arts & Sciences, Dept. of Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR76-80158 A01)

A series of experiments on single-crystal transition metals with known concentrations of hydrogen, on other pure noncubic metal single crystals, on pure germanium, and on the alkali bromides will be continued. Nuclear acoustic resonance (NAR) using both dynamic quadrupole coupling and dynamic Alpher-Rubin coupling will be employed where possible as the experimental technique. High magnetic fields up to 85 kilogauss in the temperature range from 4.2 K to 300 K will be used with on-line computer signal averaging and data analysis. The NAR dynamic quadrupole coupling and Alpher-Rubin coupling lineshapes, linewidths, and line positions of Ta181 will be studied in single-crystal tantalum as a function of hydrogen concentration and temperature in both the alpha and alpha plus beta phases. The H1 linewidths and line positions will also be studied if the resonance proves observable in tantalum. Extensions of these studies are planned for V, Nb, and Pd. NAR lineshape, linewidth, and line-position studies will be carried out at the highest magnetic fields in single-crystal Be and Mg. NAR studies using dynamic quadrupole coupling of Ge73 in pure germanium single crystal to determine lineshapes, linewidths, and the components of the tensor S relating electric field gradients to elastic strain will be carried out. Finally, NAR dynamic quadrupole coupling studies of the alkali bromides to determine the components of the tensor S observable at anion and cation nuclear positions will be done.

This is ths first year of a two-year continuing grant. Research initiated under NSF Grant No. DMR73-07629.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0019, MAGNETISM AND PHONON PROPAGATION IN METALS AND AMORPHOUS MAGNETS

T.R. Carver, Princeton University, School of Natural Sciences, Dept. of Physics, *Box 430, Princeton, New Jersey* 08540 (DMR78-15268)

Experimental research in the general area of magnetism and phonon interactions in condensed matter systems which previously was supported by NSF grant DMR-7618667 will be continued. The microwave magnetic resonance transmission techniques which were originally invented at Princeton will be developed further for studies of the critical exponents for the magnetic phase transitions in copper-nickel alloys and in iron. The studies will be done as a function of composition. Also, the technique will be used as a probe for magnetic phase transitions by a new method for generating and transmitting microwave phonons in the anomalous skin depth region of metals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, ATOMIC INTERACTIONS WITH ELECTRONS AND FIELDS IN GROUND AND EXCITED STATES

B. Bederson, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY77-28127)

A two-year research program will use atomic beam techniques for the study of interactions between atoms, electrons, radiation and applied electric fields. The principal aims are to perform increasingly rigorous tests of collision theory as applied to simple atomic and molecular systems, and to explore new methods for extracting information from collision experiments.

The atomic beam recoil technique will be used to perform electron scattering measurements of total cross sections for the 32P 3/2 state of sodium, 'superelastic' differential and total cross sections, 32P 3/2 -yields 32S 1/2, 'superelastic' differential cross sections with spin preparation and analysis after scattering for specific magnetic substates of the above reaction, and elastic scattering for 32P 3/2 m with and without spin analysis.

An additional goal of the proposed research concerns the measurements of atomic and molecular polarizabilities.

This is a continuation of work supported by NSF Grant PHY74-03999 A03.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, MICROPARTICLE CONCENTRATIONS IN RECENT POLAR ICE

R.I. Gayley, State University of New York, Buffalo Campus, School of Natural Sciences & Mathematics, Dept. of Physics, *3435 Main St., Buffalo, New York* 14214 (DPP78-18796)

Ice sheets are repositories of both precipitation and fallout of meteorites and microparticles. The precipitation is a record of the temperature of formation by year, and an entrapment of air of past atmospheres. The meteorites are records of the development of our solar system while microparticles are detailed records of atmospheric processes. Ice cores from the Greenland and Antarctic ice sheets will be studied for their microparticle content using innovative methods of extraction. Considerable ice cores are presently available for this research and no new cores need to be collected at this time. The goal of this study is to obtain new data on the content of atmospheric dust in recent

(past 100 years) ice and to determine if there exists a direct relationship between climate nd the burden of atmospheric dust.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0022, PLASMA STABILITY THEORY
A. Simon, University of Rochester, School of Engineering & Applied Science, Dept. of Mechanical & Aerospace Sciences, *260 Crittenden Blvd., Rochester, New York* 14627

This theoretical project studies the behavior of plasma to determine the conditions under which instability sets in, and the effect of nonlinearities in saturating the growth. The nonlinear theory emphasizes the threshold regime where there are only one or a few unstable modes. Calculations of the saturated state are carried out in realistic geometry, and every attempt is made to make comparisons with laboratory experiments, so as to verify the validity of existing theory. Results can suggest stabilization techniques. The linear program has concentrated on evaluating the influence of various effects on plasma stability in Tokamak and other geometries for the parameter ranges relevant to present and future devices.

SUPPORTED BY U.S. Dept. of Energy

8.0023, TRAILING-EDGE FLOWS AND THEIR INFLUENCE ON AIRFOIL NOISE
T.H. Hodgson, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Raleigh, North Carolina* 27607 (NAG 1-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0024, DETERMINATION OF NEUTRON CROSS SECTIONS & RESONANCE PARAMETERS FOR THE STABLE TELLURIUM ISOTOPES, FOR THALLIUM 205 & FOR THE OSMIUM ISOTOPES
R.R. Winters, Denison University, School of Liberal Arts, Dept. of Physics, *Box 239, Granville, Ohio* 43023 (EY-76-S-02-2696)

Problems with the errors to be assigned to the neutron sensitivity of the Total Energy Detectors at the ORELA capture facility continue to prove troublesome. Even so, the analysis of the tellurium capture cross section data continues and is expected to be completed by the end of the summer 1978.

The neutron capture and total cross sections will be measured and/or analyzed for the osmium isotopes 186, 187, and 188. These cross sections are of importance in the understanding of nucleosynthesis in stellar interiors.

In order to obtain better estimates of the parity assignments for some of the resonances in the 205 Tl plus n reaction, a series of elastic scattering cross section measurements will be made at ORELA using a separated 205 Tl target.

RESULTS: 51V(n,gamma): a) 139 resonances analyzed 2.5-215 keV using the modified least squares fitting code, LSFIT. b) S- and p- wave strength functions measured. c) The radiative widths for the s-wave resonances shown to be very large with wide fluctuations about their means. d) Paper submitted to Phys. Rev. C. 208Pb: a) 24 resonances analyzed and radiative widths determined for 13 of these. b) Two previously unreported resonances at 43.29 and 47.26 keV found. c) Paper published in The Astrophysical Journal 217, 1977.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0025, THE DYNAMICS OF FIRST AND SECOND ORDER TRANSITIONS
J.D. Gunton, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (INT78-06976)

This award will support Professor James D. Gunton of Temple University in Philadelphia for a period of two years in a program of cooperative research in theoretical physics with Professor Kyozi Kawasaki of Kyushu University in Japan. Professor Gunton will make two trips to Japan to work with Professor Kawasaki's research group, which is very strong in the field of phase transitions. Their collaboration will bring together complementary research skills in theoretical physics and is expected to be unusually productive.

The project involves a study of the dynamical properties associated with first and second order phase transitions using theoretical and mathematical models, and is an extension of theories recently developed by Professors Gunton and Kawaski involving perturbation and renormalization group techniques. This research will have applications to the dynamics of multicomponent fluid systems, a subject of current experimental research interest in atmospheric science and industrial chemistry.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0026, STUDIES IN THE CLASSICAL RELATIVISTIC DYNAMICS OF PARTICLES AND FIELDS
P. Havas, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (INT77-21692)

This award to Temple University makes it possible for Dr. Peter Havas of that institution, Dr. John Stachel of Boston University and Dr. Ivor Robinson of the University of Texas at Dallas to carry out their 'Studies in the Classical Relativistic Dynamics of Particles and Fields' in cooperation with their Mexican colleagues. The Mexican CONACYT has made a parallel grant to Dr. Jerzy F. Plebanski of the IPN and Dr. S. Hacyan of the UNAM in Mexico City.

Interparticle forces depending on the two-particle Poincare invariants, rather than the interparticle distance, and the fields that might be constructed from them will be examined. Several aspects of relativistic hydrodynamics will be considered. These include the study of approximately Poincare-invariant post-Newtonian hydrodynamic theories and relativistic hydrodynamics based upon strings, rather than points, as in the usual hydrodynamics. Complex extensions of Poincare and conformal transformations will be used to generate new solutions containing 'new' conserved quantities from 'old' solutions of Maxwell's equations. The work on exact solutions of Einstein's field equations will be continued. Techniques related to the extension of the idea of Hertz potentials to general relativity will be of particular importance. These studies are relevant to many fields such as elementary particle physics and astrophysics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0027, COOPERATIVE RESEARCH IN STATISTICAL MECHANICS - NEW CALCULATIONS OF VIRIAL AND TRANSPORT COEFFICIENTS
S.Y. Larsen, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (INT78-08782)

This grant provides travel and related costs that will enable Dr. Sigurd Larsen of Temple University to collaborate with Drs. M. Berrondo and A. Noyola of the Mexican Petroleum Institute in research on theoretical problems in statistical mechanics. These types of calculations are basic for understanding the properties of gases composed of simple atoms and molecules and of their deviations from ideal gas behavior.

The research will concentrate on the calculation of the equation of state (virial coefficients) and the transport properties of light molecules, as well as inelastic cross sections and rearrangement collisions for these molecules. This includes an approach to the evaluation of the 2nd virial coefficient based on the calculation of poles of the S matrix in the complex wave number plane and an extension of this to the quantum mechanical calculation of 3rd virial coefficients. Other problems that will be considered are nonanalyticities in h of the transport co-

efficients for hard spheres and nonspherical effects in the 2nd virial coefficient of the helium atom-hydrogen molecule system.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0028, SILICON SUPERLATTICES - THEORY AND APPLICATION TO SEMICONDUCTOR DEVICES
J.A. Moriarty, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (NAG 1-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0029, MONOLAYER PHYSICS
J.G. Dash, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR7822697)

The research proposed here is a continuation of the work sponsored under Grant DMR7623939.

The program consists of studies of monolayer films adsorbed on uniform solid surfaces at low temperatures. Experiments are designed to prepare practical examples of two-dimensional matter and investigate the thermodynamic properties of their phases and phase transitions. In addition, studies will be undertaken to explore the behavior of thin multilayer films and the approach to bulk phase. The experimental work involves a variety of techniques, several of which are under development. This research is important for an increased understanding of the fundamental role which reduced dimensionality has in the occurrence of various kinds of long-range order in physical systems of interest to condensed matter scientists.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, SOIL INTERPRETATIONS AND SOCIOECONOMIC CRITERIA FOR LAND USE PLANNING
J.G. McColl, University of California, Berkeley Campus, Agricultural Experiment Station, Dept. of Soils & Plant Nutrition, *Berkeley, California* 94720 (0062686; CA-B#-SPN-2848-RR)

OBJECTIVE: Determine biophysical and socioeconomic factors that influence non-urban land use. Organize and deliver existing bio-physical and socioeconomic land related data needed for land-use policy making and planning. Identify and develop critically needed data and interpretations for land-use policy making and planning; develop and evaluate alternatives to overcome soil limitations affecting land-use and environmental degradation.

APPROACH: A case study of Calaveras Co., CA, is underway. Changes in land-use between 1944-69 are being documented using aerial photographs, and soil-vegetation survey maps. Associations between soil characteristics and specific land-use are being investigated, as are filter fields for urban septic tank systems in unsuitable foothill soils.

PROGRESS: Documentation of soil information and land use changes in Calaveras Co., CA, is continuing using aerial photographs. A computer-based system integrates information in the California Soil-Vegetation Survey Reports with land-use criteria; it will be used to determine optimal land-use. Nitrogen-fixation in crop plants is also being studied.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, California

9.0002, NASA/HUD HOUSING AT CAPE CANAVERAL TO DEMONSTRATE FUTURE EXPERIENCE IN HOUSING SYSTEMS AND THEIR OPERATION
Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (IAA-H-XXX)

To develop a plan for building with NASA a demonstration house in Washington, D.C. Materials, system and components are to be selected from knowledge of the most advanced technology now available, or expected to be available in the next few decades, for logical projection into housing of the future outstanding A and E firms known for innovation and use of new technology will be selected for development of the program. An achievable goal such as a 'self sustaining house' will be selected as the total concept or theme of the program. Technology transfer to housing design and construction from the space, transportation, computer, medicine, communications and other industries are planned to be demonstrated to the extent possible with today's knowledge and prediction capabilities.

SUPPORTED BY U.S. Dept. of Housing & Urban Development, Office of Policy Development & Research

9.0003, SUPPORT FOR MIST AT JSC
Unknown, Northrop Services Inc., *P.O. Box 34416, Houston, Texas* 77034 (H-2853)

Operation and testing at the MIUS Integration and Test Facility located on the NASA, Johnson Space Center, Clear Lake, Texas, with DOE (ERDA, Conservation) support funding. HUD is arranging with NASA and DOE for turnover of the facility to the DOE. This allows for continued operation and maintenance. NASA is turning over a computer and data system to DOE.

SUPPORTED BY U.S. Dept. of Housing & Urban Development, Office of Policy Development & Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STUDY OF THE HOTTEST WHITE DWARFS FROM THE PALOMER-GREEN STUDY
R.F. Green, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0002, NEW SEEING-LIMITED STUDIES OF EMISSION NEBULAE
E.R. Craine, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (NAG 5-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0003, RESEARCH ON LONG EXPOSURE OBSERVATIONS OF EXTRAGALACTIC OBJECTS
W.L. Sargent, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 5-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, INVESTIGATION OF STELLAR CHROMOSPHERIC AND CORONAL ACTIVITY
H. Zirin, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAG 8-304)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0005, INVESTIGATION OF THE VARIABILITY IN THE X-RAY EMISSIONS OF EXTRAGALACTIC SOURCES
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, SPECTRAL VARIABILITY OF ACCRETING DEGENERATE DWARFS
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, IMPROVED POSITIONS OF HEAO-1 LOW-ENERGY X-RAY SOURCES (ABBREV)
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-301)

Improved positions of HEAO-1 low energy X-ray sources, an X-ray and optical study of nearby Seyfert 2 and emission line galaxies, and correlation of coronal and chromospheric activities with binary period.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, A SOFT X-RAY OBSERVATION OF PROCYON AND THE CORONAE OF BOOTES
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 8-303)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0009, THE NATURE OF DWARF NOVAE AND RELATED SYSTEMS
M. Lampton, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAGW 44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0010, RADIOACTIVE TRANSFER EFFECTS IN QUASI-STELLAR OBJECT EMISSION LINE CLOUDS
R.C. Canfield, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAGW 30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0011, THE ROTATION AND INTERNAL FLUID DYNAMICS OF THE SUN
A.S. Endal, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (NAG 5-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, OPTICAL SPECTROSCOPE STUDIES OF IDENTIFICATION OF HIGH GALACTIC LATITUDE HIGH ENERGY ASTRONOMICAL OBSERVATORY-B X-RAY SOURCES
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Astronomy, *College Park, Maryland* 20742 (NAG 8-307)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0013, COLLABORATIVE STUDIES OF SOLAR-TYPE AND OTHER CORONAE FROM HIGH ENERGY ASTRONOMICAL OBSERVATORY-B
R. Rosner, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAG 8-302)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0014, RESEARCH PROGRAM ENCOMPASSED BY SPACE ENGINEERING
R.H. Miller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 21)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

10.0015, FEASIBILITY AND DEVELOPMENT STUDY OF A MERCURIC IODIDE SOLID STATE SPECTROMETER FOR ADVANCED X-RAY ASTROPHYSICS FACILITY
G.R. Ricker, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0016, OPTICAL OBSERVATIONS OF HIGH ENERGY ASTRONOMICAL OBSERVATORY-B OBJECTS
D.E. Mook, Dartmouth College, School of Arts & Sciences, Dept. of Astronomy, *P.O. Box 833, Hanover, New Hampshire* 03755 (NAG 8-305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0017, RADIATIVELY COOLING CLUSTERS
L.L. Cowie, Princeton University, School of Natural Sciences, Dept. of Astronomy, *Box 430, Princeton, New Jersey* 08540 (NAG 8-306)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0018, X-RAY EMISSION FROM BROAD-LINE RADIO GALAXIES USING HEAO-2 & A SEARCH FOR X-RAY EMISSION FROM NEARBY QUASI-STELLAR OBJECTS (ABBREV)
T. Matilsky, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Astronomy, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NAG 8-309)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0019, AIRGLOW AND AURORAL STUDIES OF THE EARTH'S IONOSPHERE
M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ATM78-27598)

This grant funds a program of twilight and night airglow observations using passive optical techniques - chiefly Fabry-Perot (FP) interferometers, tilting filter photometers and multichannel mapping photometers. At Laurel Ridge Airglow Observatory, Pennsylvania (LRAO) continuing measurements of midlatitude thermospheric wind vectors and temperatures will provide information on scale sizes of upper atmospheric ciruclation cells and flow patterns. The data will also be correlated with simultaneous measurements by another researcher (G. Hernandez) at Fritz Peak Observatory (Colorado) during geomagnetic quiet and storm periods. The LRAO neutral wind data will also be used to test the models by which Millstone Hill incoherent

scatter measurements of ionospheric parameters are used to infer neutral motions. A new infrared FP observing He I 1.083 microns in twilight will be used to study the helium escape and high-altitude wind vectors and temperatures. At Arecibo Observatory, Puerto Rico, participation will continue in the IME (ionospheric modification experiments), correlating IME-produced changes in 630.0 nm and 557.7 nm atomic oxygen emission intensity with backscatter radar and ionosonde data to infer changes in the airglow atomic collision processes and to test the theories of electron acceleration by RF-induced plasma instabilities.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0020, ANALYSIS OF AURORAL DATA OBTAINED BY SOUNDING ROCKETS AND GROUND-BASED OBSERVATORIES

H.R. Anderson, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (ATM78-21761)

This grant supports analysis of auroral data obtained by a sounding rocket and by simultaneously operating ground stations. The sounding rocket was launched from Poker Flat, Alaska, in March 1978, and measured electron and proton velocity spectra, vector magnetic field perturbations, vector electric field and the electric field's frequency spectrum from 0 to 10 MHz. Simultaneous measurements were made by the Alaska meridian chain of observatories and by the Chatanika radar. With these data, the following studies will be carried out; 1) Comparison of calculated with measured upward moving electron flux. 2) Calculation of auroral photon emission from measured electron flux and comparison with observations. 3) Compare measured horizontal electric fields with that derived from measured Birkeland currents. 4) Compare values of electric fields, currents and conductivity derived from the rocket data with those obtained from the Chatanika radar to give a self-consistent model of auroral arcs.

The overall aim is to quantify certain aspects of auroral precipitation in order to understand the origin of the aurora.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0021, X-RAY OBSERVATIONS OF SOUTHERN HIGH-RED SHIFT CLUSTERS

C.L. Sarazin, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 8-308)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

GENERAL

11.0001, NEUROSCIENTIFIC AND BIOCYBERNETIC MODELS OF RELEVANCE FOR THE DESIGN AND DEVELOPMENT OF INTELLIGENT MACHINES

P. Suppes, Stanford University, School of Humanities & Sciences, Dept. of Philosophy, *Stanford, California 94305* (NAGW 6)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Aeronautics & Space
Technology

11.0002, PREPARATION OF NASA WHITE SANDS TEST FACILITY CAPABILITIES BROCHURE

K. Guard, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico 88003* (NAS 9-95504)

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Lyndon B. Johnson Space Center

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01 AERONAUTICS (GENERAL)

N80-29243* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 124
Jul. 1980 130 p
(NASA-SP-7037(124)) Avail: NTIS HC $15.00 CSCL 01A

This bibliography, lists 450 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1980. Author

N80-29244*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONTROL-SYSTEM TECHNIQUES FOR IMPROVED DEPARTURE/SPIN RESISTANCE FOR FIGHTER AIRCRAFT
Luat T. Nguyen, William P. Gilbert, and Marilyn E. Ogburn Aug. 1980 69 p refs
(NASA-TP-1689; L-13453) Avail: NTIS HC A04/MF A01 CSCL 01C

Some fundamental information on control system effects on controllability of highly maneuverable aircraft at high angles of attack are summarized as well as techniques for enhancing fighter aircraft departure/spin resistance using control system design. The discussion includes: (1) a brief review of pertinent high angle of attack phenomena including aerodynamics, inertia coupling, and kinematic coupling; (2) effects of conventional stability augmentation systems at high angles of attack; (3) high angle of attack control system concepts designed to enhance departure/spin resistance; and (4) the outlook for applications of these concepts to future fighters, particularly those designs which incorporate relaxed static stability. R.C.T.

N80-29245*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
***SUBSONIC AIRCRAFT: EVOLUTION AND THE MATCHING* OF SIZE TO PERFORMANCE**
Laurence K. Loftin, Jr. Aug. 1980 445 p refs
(NASA-RP-1060; L-13367) Avail: NTIS HC A19/MF A01 CSCL 01B

Methods for estimating the approximate size, weight, and power of aircraft intended to meet specified performance requirements are presented for both jet-powered and propeller-driven aircraft. The methods are simple and require only the use of a pocket computer for rapid application to specific sizing problems. Application of the methods is illustrated by means of sizing studies of a series of jet-powered and propeller-driven aircraft with varying design constraints. Some aspects of the technical evolution of the airplane from 1918 to the present are also briefly discussed. Author

N80-29246# CACI, Inc. - Federal, Arlington, Va.
***AVIATION COMPONENT REPAIR PROGRAM ANALYSIS,* VOLUME 1 Final Report**
Mar. 1980 65 p
(Contract N00014-80-C-0097)
(AD-A086060) Avail: NTIS HC A04/MF A01 CSCL 15/5

Depot repair of aviation repairable components supports the flight operations of the U.S. Navy and Naval Reserve Aircraft. In order to determine an appropriate measure of effectiveness which could be used to assess the impact of the component repair program, several statistical analyses were performed comparing financial and other data related to the Aviation Component Repair Program, data in aviation related programs and various effectiveness measures. GRA

N80-29247# Cost Analysis Improvement Group, Washington, D.C.
AIRCRAFT OPERATING AND SUPPORT COST DEVELOPMENT GUIDE
15 Apr. 1980 23 p
(AD-A085854) Avail: NTIS HC A02/MF A01 CSCL 14/1

This document provides guidelines for preparing and presenting estimates of operating and support (O S) costs to the OSD Cost Analysis Improvement Group (CAIG) and the Defense Systems Acquisition Review Council (DSARC). These guidelines are intended to achieve consistent and effective preparation and documentation of major system O S cost estimates. This guide updates and expands the CAIG 'Cost Development Guide for Aircraft Systems' originally published in May 1974. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also 34 Fluid Mechanics and Heat Transfer.

N80-29248# National Inst. for Aeronautics and Systems Technology, Pretoria (South Africa).
***A BASIC COMPUTER PROGRAM FOR THE EVALUATION* OF THE INVISCID VELOCITY DISTRIBUTION ALONG BODIES OF REVOLUTION IN AXIAL FLOW**
R. A. Streather Oct. 1979 25 p refs
(CSIR-NIAST-79/116; ISBN-0-7988-1432-1) Avail: NTIS HC A02/MF A01

A rapid method is developed for calculating the velocity distribution along the surface of arbitrary bodies of revolution in inviscid flow. The method is programmed in BASIC for local operation on the Tektronix 4051 computer or for more rapid operation on the CDC Cyber 174 computer. Comparison is made with the exact potential flow solution for an ellipsoid of revolution and with experimental wind tunnel results for an aircraft fuselage. R.K.G.

N80-29249*# Grumman Aerospace Corp., Bethpage, N.Y.
TOWARDS COMPLETE CONFIGURATIONS USING AN *EMBEDDED GRID APPROACH* Final Report
Charles W. Boppe Washington, D.C. Jul. 1978 19 p refs
(Contract NAS1-14732)

(NASA-CR-3030) Avail: NTIS HC A02/MF A01 CSCL 01A

A new approach to simulating transonic flow about transport configurations is briefly outlined. The methods embedded grid *scheme provides a high degree of computational resolution coupled* with geometric flexibility for future applications to complex shapes. Calculations presented illustrate aspects of transonic transport *design including fuselage design, determination of wing control* surface deflection effectiveness, and wing design. Author

N80-29250*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE EFFECT OF THROAT CONTOURING ON TWO-DIMENSIONAL CONVERGING-DIVERGING NOZZLES AT STATIC CONDITIONS

Mary L. Mason, Lawrence E. Putnam, and Richard J. Re Aug. 1980 70 p refs

(NASA-TP-1704; L-13591) Avail: NTIS HC A04/MF A01 CSCL 01A

An experiment was conducted at static conditions to determine the internal performance effects of nozzle throat *contouring, the result of increasing the circular-arc throat radius.* Five nonaxisymmetric converging-diverging nozzles were tested at nozzle pressure ratios up to 9.0. Data are presented as internal *thrust ratios, discharge coefficients, and static-pressure distribu-*tions. Comparisons of internal performance data for the five nozzles show that throat contouring increases the value of discharge *coefficient but has no significant effect on internal thrust ratio* except in cases of internal flow separation. To illustrate the use *of the two dimensional converging-diverging (2-D C-D) nozzle* data base, a two dimensional inviscid theory was applied to the five configurations. The generally good agreement of data with *theoretical results indicates that two-dimensional inviscid theory* can be successfully applied to the prediction of 2-D C-D nozzle internal flow. Author

N80-29251*# Stanitz (John D.), University Heights, Ohio.

GENERAL DESIGN METHOD FOR THREE-DIMENSIONAL POTENTIAL FLOW FIELDS. 1: THEORY Final Report

John D. Stanitz Washington, D.C. Aug. 1980 82 p refs (Contract NAS3-21605)

(NASA-CR-3288) Avail: NTIS HC A05/MF A01 CSCL 01A

A general design method was developed for steady, three dimensional, potential, incompressible or subsonic-compressible flow. In this design method, the flow field, including the shape of its boundary, was determined for arbitrarily specified, continuous distributions of velocity as a function of arc length along the boundary streamlines. The method applied to the design of both internal and external flow fields, including, in both cases, fields with planar symmetry. The analytic problems associated with stagnation points, closure of bodies in external flow fields, and prediction of turning angles in three dimensional ducts were reviewed. R.C.T.

N80-29252# Army Research and Technology Labs., Moffett Field, Calif.

DYNAMIC STALL ON ADVANCED AIRFOIL SECTIONS

W. J. McCroskey, K. W. McAlister, L. W. Carr, S. L. Pucci, O. Lambert (Service Technique des Construction Aeronautiques, Paris), and R. F. Indergand (Mather AFB, Calif.) May 1980 26 p refs Presented at the 36th Annual Forum of the Am. Helicopter Soc., Washington, D.C., May 1980

(AD-A085809) Avail: NTIS HC A03/MF A01 CSCL 01/2

The dynamic stall characteristics of eight airfoils have been investigated in sinusoidal pitch oscillations over a wide range of two dimensional unsteady flow conditions. The results provide a unique comparison of the effects of section geometry in a simulated rotor environment. Important differences between the various airfoils were observed, particularly when the stall regimes were penetrated only slightly. Under these circumstances, the profiles that stall gradually from the trailing edge appear to offer an advantage. However, all of the airfoils tended increasingly toward leading-edge stall when both the severity of dynamic stall and the free-stream Mach number increased. In all cases, the parameters of the unsteady motion appear to be more important than airfoil geometry for configurations that are appropriate for helicopter rotors. GRA

N80-29253*# Aerospace Systems, Inc., Burlington, Mass.

STEADY, OSCILLATORY, AND UNSTEADY SUBSONIC AERODYNAMICS, PRODUCTION VERSION 1.1 (SOUSSA-P 1.1). VOLUME 2: USER/PROGRAMMER MANUAL

Scott A. Smolka, Robert D. Preuss, Kadin Tseng, and Luigi Morino Jun. 1980 184 p refs (Contract NAS1-14977)

(NASA-CR-159131) HC A09/MF A01 CSCL 01A

A user/programmer manual for the computer program SOUSSA P 1.1 is presented. The program was designed to provide accurate and efficient evaluation of steady and unsteady *loads on aircraft having arbitarary shapes and motions, including* structural deformations. These design goals were in part achieved through the incorporation of the data handling capabilities of *the SPAR finite element Structural Analysis computer program.* As a further result, SOUSSA P possesses an extensive check-point/ restart facility. The programmer's portion of this manual *includes overlay/subroutine hierarchy, logical flow of control,* definition of SOUSSA P 1.1 FORTRAN variables, and definition of SOUSSA P 1.1 subroutines. Purpose of the SOUSSA P 1.1 *modules, input data to the program, output of the program,* hardware/software requirements, error detection and reporting capabilities, job control statements, a summary of the procedure *for running the program and two test cases including input and* output and listings are described in the user oriented portion of the manual. R.K.G.

N80-29254*# National Aeronautics and Space Administration. *Langley Research Center, Hampton, Va.*

A COMPUTER PROGRAM FOR THE DESIGN AND ANALYSIS OF LOW-SPEED AIRFOILS

Richard Eppler (Stuttgart Univ., West Germany) and Dan M. Somers Aug. 1980 145 p refs

(NASA-TM-80210; L-12937) Avail: NTIS HC A07/MF A01 CSCL 01A

A conformal mapping method for the design of airfoils with prescribed velocity distribution characteristics, a panel method for the analysis of the potential flow about given airfoils, and a boundary layer method have been combined. With this combined method, airfoils with prescribed boundary layer characteristics can be designed and airfoils with prescribed shapes can be analyzed. All three methods are described briefly. The program and its input options are described. A complete listing is given as an appendix. Author

N80-29255*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ANALYSIS OF TRANSONIC SWEPT WINGS USING ASYMPTOTIC AND OTHER NUMERICAL METHODS

H. K. Cheng, S. Y. Meng, R. Chow (Grumman Aerospace Corp., Bethpage, N.Y.), and R. Smith May 1980 31 p refs Presented at the 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980 Prepared in cooperation with Univ. of Southern California, Los Angeles

(Contract N00014-75-C-0520; NR Proj. 061-192)

(NASA-TM-80762; AD-A085587; USCAE-138) Avail: NTIS HC A03/MF A01 CSCL 20/4

Asymptotic theories for high-aspect-ratio wings in transonic flow developed recently show that the three dimensional (3-D) mixed-flow calculations may be reduced to solving a set of 2-D problems at each span station. For wings with surfaces generated from a single airfoil shape, local similitude exists in the 3-D flow structure, permitting the problems to be solved once for all span stations. This paper reviews this theoretical development. The essential elements in the theory will be identified. Their relationship to the lifting-line theory and related classical methods are discussed. Examples of similarity solutions are demonstrated for high subcritical and slightly super-critical component flows; comparisons with relaxation solutions to a full potential equation are made. The study also examines the adequacy of the existing full-potential computer code. Outstanding problems remaining for subsequent development are discussed. GRA

N80-29256# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DEVELOPMENT AND APPLICATION OF A SUBSONIC

TRIANGULAR VORTEX PANEL M.S. Thesis
John C. Sparks Jun. 1980 86 p refs
(AD-A085595; AFIT/GAE/AE/80J-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

Paneling methods are approximate techniques for solving flow problems over wings and bodies. Vortex panels are used to model flow over wings and other lifting surfaces. The author *develops a triangular vortex panel having a vorticity distribution* that can vary in magnitude and direction. This panel is used to predict the pressure distribution on a rectangular and a sweptback *wing in subsonic flow. Lift distributions obtained compare favorably* to Anderson's solution and wind tunnel results except near the wing tip. In this region, the distribution will spike before *satisfying the Kutta condition imposed at the tip. Possible remedies* for the tip problem are discussed. GRA

N80-29257# *Air Force Aero Propulsion Lab., Wright-Patterson* AFB, Ohio. Ramjet Engineering Div.
CALCULATION TECHNIQUES FOR INVISCID TWO-DIMENSIONAL SUPERSONIC AIRFLOW Final Report, Sep. 1977 - Dec. 1978
M. Brian Bergsten Sep. 1979 135 p refs
(AF Proj. 3012)
(AD-A085327; AFAPL-TR-79-2023) Avail: NTIS
HC A07/MF A01 CSCL 20/4

Techniques for calculating the change in properties of inviscid supersonic airflow passing over or through various two dimensional *bodies are discussed in this report. Low supersonic (M less than* 4) airflows and high supersonic (M greater than 4) airflows are considered separately. Flow phenomena considered include normal *shock waves, oblique shock waves, insentropic expansions, and* conical shock waves for cones at zero degrees angle of attack. The adjustments required for swept wings are also discussed. *Printouts of computer subroutines designed to carry out the* described calculation procedures are included in an appendix to the report. Examples describing the use of the calculation techniques and computer subroutines for a swept wing, and for two typical ramjet inlets are included. A final appendix includes *charts that can be used as calculation aids for airflows at Mach* numbers up to 4. GRA

N80-29258# ARO, Inc., Arnold Air Force Station, Tenn.
BOUNDARY LAYER MEASUREMENTS ON SLENDER BLUNT CONES AT FREE-STREAM MACH NO. 8 Final Report, 21-25 Sep. 1979
L. G. Siler and J. C. Donaldson AEDC Dec. 1979 59 p refs
(AF Proj. 2300)
(AD-A085712; AEDC-TSR-79-V71) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Boundary layer profiles and surface conditions were measured on a slender cone with various nose bluntnesses with a laminar boundary layer and with the wall temperature in a state of equilibrium. The measurements were made at a free-stream Mach number of 8 for unit Reynolds numbers from 1.3 to 3.5 million per foot. Surveys were made using a hot-wire anemometer and total temperature and pressure probes. Descriptions of the test apparatus, procedures, and techniques used are given in this report. GRA

N80-29259# Transportation Systems Center, Cambridge, Mass.
GROUND WIND VORTEX SENSING SYSTEM CALIBRATION TESTS Final Report, Apr. 1971 - Nov. 1972
T. E. Sullivan and D. C. Burnham Feb. 1980 85 p refs
(AD-A085647; TSR-FAA-80-4; FAA-RD-80-13) Avail: NTIS
HC A05/MF A01 CSCL 14/2

This report describes the collection of data related to the calibration of two systems for detecting and tracking aircraft wake vortices. The systems tested were the propeller anemometer Ground Wind Vortex Sensing System and the Pulsed Acoustic Vortex Sensing System. The data were analyzed and the location of the vortices as determined with these systems were compared with the vortex location as determined photographically. The tests were conducted at the Federal Aviation Administration's National Aviation Facilities Experimental Center, in Atlantic City, N. J. GRA

N80-29260# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ALGORITHM FOR ESTIMATING AERODYNAMIC STATIC *MOMENTS OF LONG ROD PENETRATORS AT 2 LESS THAN* M LESS THAN 5
William F. Donovan May 1980 49 p
(DA Proj. 1L1-62618-AH-80)
(AD-A086095; AD-E430468; ARBRL-MR-03020) Avail: NTIS
HC A03/MF A01 CSCL 20/4

Estimation of the aerodynamic normal force and static moment of a given class of flight vehicles is demonstrated with reference to AMCP 706-280, which in turn derives from the classic British *work "Wings". By means of linearized algebraic reduction, a* transmutation permits the designer to quickly evaluate the effects of variation on the flight system. GRA

N80-29261# Pennsylvania State Univ., University Park. Applied Research Lab.
A METHOD OF CORRECTING FOR THE EFFECTS OF THE SIDEWALL BOUNDARY LAYER IN TWO DIMENSIONAL AIRFOIL TESTING
Paul P. Jacobs, Jr. 31 Mar. 1980 157 p refs
(Contract N00024-79-C-6043)
(AD-A086079; ARL/PSU/TM-80-44) Avail: NTIS
HC A08/MF A01 CSCL 20/4

This thesis presents the results of a hydrofoil force balance *design study in which the influence of sidewall boundary layers* on two dimensional force measurements is emphasized. Past problems encountered with the present hydrofoil force balance *at the Applied Research Laboratory of The Pennsylvania State* University are reviewed in order to provide background information for the present study and a two phase test program designed *to identify those factors associated with the presence of sidewall* boundary layers which can influence two dimensional force measurement in water tunnels and wind tunnels is presented. GRA

N80-29262# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
TRANSONIC AIRFOILS: THE DESIGN OF A SUPERCRITICAL WING FOR TRANSPORT AIRCRAFT *Final Report*, Oct. 1978
Guenter Krenz Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 85 p *refs* In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-11; PR-2) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 17,45

As part of the Airbus A 300 B10 (A310) development program, the design and wind tunnel characterization of four supercritical wings in a transonic flow are reported on. Wind tunnel measurements made on airfoil profiles are analyzed. Results are used in the choice of a wing configuration for a full scale model to be subjected to further transonic wind tunnel tests. Model construction and data collection schemes are discussed. Transonic flow theory is also considered. At present, the influence of the engine assembly on the wing configuration and its flow field has yet to be satisfactorily calculated. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N80-29263# Aeronautical Research Labs., Melbourne (Australia).
THE STRENGTH OF OCCUPANT RESTRAINT SYSTEM IN LIGHT AIRCRAFT: AN EXPERIMENTAL EVALUATION
S. R. Sarrailhe Feb. 1979 40 p
(ARL-Struc-Rept-375; AR-001-600) Avail: NTIS
HC A03/MF A01

The cabins and restraint systems of three cyclone-damaged light aircraft were tested statically to determine the strength of the restraint system in the cabin. It was found that most restraining components were much stronger than demanded by the 9 g requirement and it was considered that only minor improvements

would be needed to ensure 25 g capability. Seats were not as strong as the restraints and their behavior under crash load conditions requires further investigation. Author

N80-29264# Federal Aviation Administration, Washington, D. C.
FIRST COMMUTER AIR CARRIER SAFETY SYMPOSIUM
Jan. 1980 253 p Symp. held at Washington, D.C., 16-17 Jan. 1980
(AD-A085628) Avail: NTIS HC A12/MF A01 CSCL 01/2

This is the first commuter air carrier safety symposium held by the FAA. The objective is to review the significant problems which are inseparable from safety issues. Most of the accidents which have occurred in the last several years have involved recurring contributing factors, in operations, maintenance, and training, and most are truly avoidable. The program is directed toward a listening session and regulatory overview; the industry presented its perspectives with reliability, and air-worthiness; human factors considerations in accident prevention; and the prospects of, or needs for, airport and airway development for commuter service. GRA

N80-29265# Battelle Columbus Labs., Ohio.
EVALUATION OF SAFETY PROGRAMS WITH RESPECT TO THE CAUSES OF AIR CARRIER ACCIDENTS
T. M. Connor and C. W. Hamilton Jan. 1980 257 p refs
(Contract DOT-FA77WA-4072)
(AD-A085347; FAA-ASP-80-1) Avail: NTIS HC A12/MF A01 CSCL 13/12

The objective of this study was to determine the extent to which the FAA safety programs were aligned with the causes of air carrier accidents. The data base used in this study consisted of a total of 760 air carrier accident records compiled by the National Transportation Safety Board (NTSB) from 1966 through 1975. Analysis of these records was made with respect to NTSB-cited cause/factors. FAA programs implemented during the study time period and pertaining to safety were also included in this study. Conclusions of this study are: (1) no substantive change is required with respect to mechanical safety programs, (2) broader investigation into the integration of environmental programs with human factors programs is required, (3) new program initiatives addressing human error problems in behavior terms are required. GRA

N80-29266# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
THE CURRENT ROLE OF ALCOHOL AS A FACTOR IN CIVIL AIRCRAFT ACCIDENTS
Leonard C. Ryan and Stanley R. Mohler (Wright State Univ.) May 1980 13 p refs
(AD-A086261; FAA-AM-80-4) Avail: NTIS HC A02/MF A01 CSCL 01/2

Ethyl alcohol continues as a serious adverse factor in general aviation flight safety. According to FAA figures, the level of alcohol-associated general aviation fatal accidents has remained relatively static at a 16% general level since 1969. A recent survey of the attitudes of pilots toward alcohol and flying reveals a lack of appreciation among one-third of the pilots concerning the adverse effects of alcohol and safe flight. A renewed pilot education program on alcohol and flight safety appears indicated. GRA

N80-29267# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
ACTIVE BCAS PERFORMANCE IN A GARBLE ENVIRONMENT
Edmund J. Koenke 24 Jan. 1980 50 p refs
(AD-A086046; FAA-EM-80-1) Avail: NTIS HC A03/MF A01 CSCL 01/2

A basic design tool has been developed which includes the principal BCAS design parameters, namely, transmitter power, receiver sensitivity, aircraft density, closure rate, degarble capability, and interrogation rate. This tool can be directly applied to the evaluation of alternative BCAS design concepts as well as for parametric design studies. Results of a comparison between an ATCRBS/DABS BCAS and an ATCRBS only BCAS are presented leaving little doubt concerning the performance advantage offered by the inclusion of the DABS link for evasive maneuver coordination. It must be emphasized that neither of the BCAS systems analyzed in this report are representative of the acolitive BCAS defined in the draft National Standard for active BCAS. GRA

N80-29268# Ultrasystems, Inc., Irvine, Calif.
FLUID CONTAMINATION OF AIRCRAFT-CABIN AIR AND BREATHING OXYGEN Final Report, 19 Jun. 1978 - 19 Jun. 1979
K. L. Paciorek, J. H. Nakahara, and R. H. Kratzer Dec. 1979 53 p
(Contract F33615-78-C-0612; AF Proj. 7930)
(AD-A085818; SN-8331-F; SAM-TR-79-34) Avail: NTIS HC A04/MF A01 CSCL 01/3

From different manufacturers, a series of lubricating oils (MIL-L-7808), hydraulic fluids (MIL-H-5606), and heat-transfer fluids (MIL-C-47220) were obtained to test their potential for contaminating aircraft breathing air and oxygen. No significant differences were detectable in the compositions of lubricating oils and hydraulic fluids, irrespective of the origin, including fluids recovered after service in an aircraft. The two heat-transfer fluids of interest were single compounds. Under normal operating conditions, the hydraulic and heat-transfer fluids afforded minimal quantities of products. The lubricating oils volatized to a large degree; the mists consisted essentially of unchanged starting materials. Tests simulating line rupture with fluid spilling onto a hot, 450 C (850 F), metal surface in the presence of air resulted in excessive fluid degradation. In all instances, significant quantities of hydrocarbons, carbonyls, and alcohols were produced. Among these, the highly toxic formaldehyde, acrolein, formic acid, and formates were found and quantitated. GRA

N80-30013# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
HUMAN FACTORS IN HIGH-SPEED LOW-LEVEL ACCIDENTS: A 15 YEAR REVIEW
R. C. Rud and D. F. Leben *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30015# Bureau of Medicine and Surgery (Navy), Washington, D. C.
NAVAL AVIATION WATER SURVIVAL PROGRAM
Wilton McIntosh *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30016# Martin-Baker Aircraft Co. Ltd., Denham (England).
HIGH-SPEED, LOW-LEVEL FLIGHT SURVIVAL ON EJECTION
M. A. A. Hobbs *In* AGARD High-Speed, Low-Level Flight Mar. 1980 2 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30017# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MINIMIZING THE SEQUENCED DELAY TIME FOR ESCAPE FROM HIGH-SPEED, LOW-LEVEL FLIGHT PROFILES
James H. Raddin, Jr., Lawrence J. Specker, and James W. Brinkley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30018# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
LOW LEVEL, ADVERSE ATTITUDE ESCAPE USING A VERTICAL SEEKING EJECTION SEAT
John J. Tyburski, Georg D. Frisch (Naval Aerospace Medical Research Lab., New Orleans, La.), and Louis A. Daulerio *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-29269# ECON, Inc., Princeton, N. J.
THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME 1: EXECUTIVE SUMMARY Final Report
F. M. Sand and M. L. Balinski 15 Apr. 1980 50 p refs 3 Vol.
(Contract DOT-FA79WA-4374)
(AD-A085739; FAA-AVP-80-3-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 01/2

The allocation of runway slots at the high-density airports by means of an auction is studied. Previous approaches to slot auctions have not allowed for the interdependency of slot values to the air carriers; a single slot for a landing of an aircraft is likely to be of little value without a corresponding slot for a subsequent take-off of that aircraft. A Slot Exchange Auction is designed, its theoretical properties and practical implementation discussed. It is shown to allow the slot market to reach an efficient equilibrium under competitive conditions. The Airline Management Game is used to create a simulation test of the Slot Exchange Auction and its associated continuous market, the slot exchange. GRA

N80-29270# ECON, Inc., Princeton, N. J.
THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME 2: THE AIRLINE MANAGEMENT GAME AND SLOT AUCTION TESTING Final Report
F. M. Sand and M. L. Balinski Apr. 1980 178 p refs Prepared in cooperation with Flight Transportation Associates, Cambridge, Mass. 3 Vol.
(Contract DOT-FA79WA-4374)
(AD-A085438; FAA-AVP-80-3-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 01/2

A specific mechanism for allocating slots between competing air carriers based on a sequential auction procedure is analyzed. The mechanism is shown to achieve an efficient slot solution where one exists. In case there is no efficient solution, it is proposed that the slot market remain open continuously throughout the six months of operations so that air carriers can exchange slots on the open slot market in order to improve the balance between slot allocations and flight schedules. The continuous slot exchange has the additional advantage that it allows changes in the allocation of scarce runway capacity in response to changing economic and air transportation conditions. J.M.S.

N80-29271# ECON, Inc., Princeton, N. J.
THE ALLOCATION OF RUNWAY SLOTS BY AUCTION. VOLUME 3: THEORY AND TECHNICAL ISSUES FOR IMPLEMENTATION Final Report
F. M. Sand and M. L. Balinski Apr. 1980 87 p refs 3 Vol.
(Contract DOT-FA79WA-4374)
(AD-A085455; AVP-80-3-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 01/2

In order to evaluate the viability of the slot exchange auction and subsequent continuous slot exchange, an interactive computer simulation of actual slot auctions was conducted using the Airline Management Game. The scenario included 5 competing airlines and 17 airports with 3 of them being capacity-limited. Hourly quotes for the airports were established based on the airport activity profiles obtained in the base case. The participants were instructed to maximize short-run airline profits using a fixed fleet of aircraft and fixed fares, but free choice of routes and schedules. The schedules were assumed to operate for six months at a time. The Airline Management Game is outlined, and the experimental design, the bidding rules, and the results and analyses of the evaluation exercise are included. The testing of the slot allocation methods is demonstrated. The test was inconclusive in regard to convergence to equilibrium and the economic efficiency and equitability of the slot exchange method. J.M.S.

N80-29272# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
WIND FACTOR SIMULATION MODEL: USER'S MANUAL Final Report
Roger C. Whiton and Patrick L. Herod Apr. 1980 66 p
(AD-A085486; USAFETAC/TN-80/002) Avail: NTIS HC A04/MF A01 CSCL 09/2

User instructions and a concise description are provided for a Wind Factor Simulation Model (WFSM). The WFSM is a fast, economical module designed to reside as a collection of subroutines within the user's larger simulation model. The WFSM, upon call by the user, produces mean overall climatological wind factors for great circle routes between arbitrary man overall climatological wind factors for great circle routes between arbitrary points 'A' and 'B' (specified by latitude and longitude) anywhere on the globe. The WFSM produces wind factors in any of three modes (calm wind case, 90 percent worst case, and the mean wind case), for either of two altitudes (25,000 ft and 35, 000 ft) for any of four seasons of the year. In addition, the model can provide great circle distance between points 'A' and 'B'. From this information and known airspeed, the user can calculate ground speed and adjusted flying time between 'A' and 'B'. Software solves the equation of a great circle. Program listing and flow chart are included. GRA

N80-29273# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
SYSTEMS RESEARCH AND DEVELOPMENT SERVICE REPORT OF R AND D ACTIVITY
Nathan Aronson, Gary R. Rowland, Donald L. Scheffler, James P. Dugan, and Parker E. Harris, Jr. May 1980 189 p refs
(AD-A085629; FAA-RD-80-54) Avail: NTIS HC A09/MF A01 CSCL 17/7

Recent achievements and results expected in the near future are discussed in 26 technical papers covering the following areas: terminal information processing; metering and spacing for automated radar terminal systems; electronic tabular display systems; en route minimum safe attitude warning function integrated with the current NASA automation system; en route display recording/playback; airport surface detection equipment surveillance radar; digital radar for air traffic control terminal areas; discrete address beacon system link applications; moving target detectors; automatic traffic advisory and resolution service; beacon collision avoidance system; airport security systems: bomb and explosives detection; air transport cockpit alerts/warning systems; helicopter development program; LORAN-C development; wind shear program; head-up displays for civil aviation; systems characterizing thunderstorms for safe aircraft operations; automation of aviation weather observations; computer generated voice response; automated route forecasts; and the FAA remote terminal system frequency assignment model. A.R.H.

N80-29274# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
WIND FACTOR SIMULATION MODEL: MODEL DESCRIPTION Final Report
Roger C. Whiton and Patrick L. Herod Apr. 1980 38 p refs
(AD-A085733; USAFETAC/TN-80/001) Avail: NTIS HC A03/MF A01 CSCL 17/7

A simplified, small and efficient Wind Factor Simulation (WFSM) is developed for inclusion in a Military Airlift Command (MAC) airlift system simulation called COLOSSUS. The WFSM calculates climatological wind factors by Sawyer's equivalent headwind technique for arbitrary great circle routes at specified altitudes for any of four seasons in any of three wind options. This technique is combined with the mathematics of great circle navigation in a constellation of seven FORTRAN subprograms. in the WFSM, a simulated aircraft is navigated along a great circle route between any two points on the globe. Involved in the mathematics of the navigation is solving the equation of a great circle. This equation is sometimes transcendental. In those cases, Newton's iterative method for the solution of nonlinear algebraic equations is used. The WFSM also calculates the great circle distance in nautical miles and the initial heading in degrees of any two points whose latitude and longitude are known. GRA

N80-29275# Westinghouse Electric Corp., Baltimore, Md.
FAR FIELD MONITOR FOR INSTRUMENT LANDING SYSTEMS, PHASES 1 AND 2 Interim Report
R. More, J. C. Bradley, and B. Newman Nov. 1979 318 p refs
(Contract DOT-FA75WA-3689)
(AD-A079663; FAA-RD-79-7023) Avail: NTIS HC A14/MF A01 CSCL 17/7

This report describes a study performed to determine the nature of scattering of ILS radiated signals by objects on the airport property. These included both taxiing and overflying aircraft. The interaction of this scattered energy with the direct radiation was studied to determine the derogating effects of ILS guidance. This resulted in the development of four system level concepts for detecting glide path derogation. One technique, the Vector DDM, was selected as being most practical from a sensitivity, reliability, and cost point-of-view. GRA

N80-29276# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DISCRETE ADDRESS BEACON SYSTEM (DABS) BASELINE TEST AND EVALUATION Interim Report, Jun. - Sep. 1979
M. Holtz, W. Swanseen, M. Karlin, R. Spadea, and D. Fisher Apr. 1980 142 p refs
(FAA Proj. 034-241-510)
(AD-A085585; FAA-NA-79-52; FAA-RD-80-36) Avail: NTIS HC A07/MF A01 CSCL 17/7

Tests and evaluation (T E) were conducted principally to determine baseline performance characteristics of the Discrete Address Beacon System (DABS) sensor employing the software and associated parameter values as delivered by Texas Instruments (TI), Incorporated in June 1979. A secondary objective was to highlight those areas where changes in system parameters, made necessary by the maturing of the DABS/Automatic Traffic Advisory and Resolution Service (ATARS) system concept, would require further study and test prior to issuance of the Technical Data Package (TDP). Simulation techniques, targets of opportunity, and DABS transponder-equipped aircraft were used. The DABS sensor test program was accomplished with an Air Traffic Control Radar Beacon System (ATCRBS) 5 foot antenna having a 2.4 deg beam width, and the DABS sensor transmitter power output and effective beam width values as delivered by the contractor. Data reduction and analysis tools developed by the National Aviation Facilities Experimental Center (NAFEC) were used to determine sensor performance characteristics and to highlight areas for further analysis. It was concluded that, with few exceptions, the DABS engineering model in the implementation tested performed in compliance with or exceeded the requirements as defined in the DABS Engineering Requirements (FAA-ER-240-26). Those exceptions are discussed in the body of the report along with recommendations for further activity. GRA

N80-29277# Mitre Corp., Bedford, Mass.
LORAN NAVIGATION SYSTEM
J. L. Howard May 1980 84 p refs
(Contract F19628-79-C-0001)
(AD-A085646; M79-206; ESD-TR-80-121) Avail: NTIS HC A05/MF A01 CSCL 17/7

LORAN is a highly accurate source of positioning information that can also be used for precision time reference. This report presents an overview of the LORAN navigation system for the general reader. Basic system characteristics and relationships provide a background in LORAN navigation and signal processing that applies to LORAN receivers in current use. Data for available LORAN transmitter chains are included with the report. GRA

N80-29278# Boston Coll., Chestnut Hill, Mass.
SIGNAL DETECTION/ANALYSIS OF IONOSPHERIC AND GROUND WAVE PROPAGATION Final Report, 1 Jul. 1975 - 30 Sep. 1977
William C. McComish Griffiss AFB, N.Y. RADC 1 Apr. 1978 47 p refs
(Contract F19628-76-C-0006; AF Proj. 2305)
(AD-A085757; BC-SDAL-78-1; RADC-TR-78-198) Avail: NTIS HC A03/MF A01 CSCL 17/7

The theory and application of various types of analysis and data processing for both ionospheric HF signal propagation and groundwave LF propagation are discussed with particular emphasis on the maximum entropy estimator method, its derivation and application to data from the Doppler arrival angle spectral measurements (DAASM) program and to the sea backscatter measurements from the Ava-Dexter HF radar facility of Rome Air Development Center. Efforts to extract the most information regarding radar refraction and electron density profiles from a survey of vertical incidence ionograms, using existing techniques and programs, are also examined. GRA

N80-29279# Performance Measurement Associates, Inc., Vienna, Va.
DATA ANALYSIS METHODOLOGY FOR DAY/NIGHT INFLIGHT TACTICAL NAVIGATION Final Report, 8 Aug. 1977 - 19 Mar. 1979
Edward M. Connelly and Robert F. Comeau Sep. 1979 127 p
(Contract DAHC19-77-C-0042; DA Proj. 2Q2-63743-A-772)
(AD-A082731; PMA-7-79; ARI-TR-411) Avail: NTIS HC A07/MF A01 CSCL 17/7

Low-level helicopter navigation, both at night and during the day, is an essential portion of the Army's mission. Navigation performance, defined as the probability of navigating along a prescribed route or route segment without deviation, is a function of many factors including map type, terrain type, and time of day. Determining the effects of these factors is important for predicting performance of Army navigators, identifying factors critical to navigation, evaluating the probability of navigation success along a route, and developing training aids. The research reported here analyzed low-level flight experiment data to develop that information. This report contains results of the analyses of helicopter low-level navigation data, (a) to determine the probability of navigation success along a route as a function of terrain type, (b) to develop a means of determining route difficulty, and (c) to develop a method of scoring student performance. The FORTRAN computer programs and the navigation data base used in the analysis are also documented. GRA

N80-29280# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF THE AIRPORT SURVEILLANCE RADAR (ASR)-8 WIND SHEAR DETECTION SYSTEM, PHASE 2 Interim Report, Apr. - Dec. 1979
D. L. Offi, W. Lewis, T. Lee, and A. DeLaMarche May 1980 41 p refs
(AD-A086045; FAA-NA-80-17; FAA-RD-80-21) Avail: NTIS HC A03/MF A01 CSCL 17/9

A wind shear detection system developed by the Wave Propagation Laboratory to operate with the Federal Aviation Administration (FAA) Airport Surveillance Radar (ASR)-8 was installed and is being tested at the FAA Technical Center. Second phase tests compared radar with aircraft and tower winds, evaluated the wind shear measurement capability under various weather conditions, and investigated the effectiveness of a simple two azimuth pointing strategy and system capabilities and limitations. Results showed the system to be compatible with and to operate satisfactorily with the ASR-8. The processing and spectral display of clear air and precipitation returns is feasible. The accuracy of agreement between radar-measured winds and components of the aircraft-measured winds in both radially oriented flights and runway offset flights, using a two azimuth pointing technique, was examined. Radar versus tower wind agreement was also examined. Potentially dangerous wind shears associated with weather during these tests were detectable. Certain system limitations also have been defined and considered. It is recommended that tests continue to complete definition of and demonstrate capabilities in all weather situations. GRA

N80-29281# Transportation Systems Center, Cambridge, Mass.
INTERFERENCE AND NOISE IN AND ADJACENT TO THE LORAN-C SPECTRUM AT AIRPORTS Final Report, Sep. - Dec. 1979
Peter G. Mauro May 1980 96 p refs Prepared for FAA, Washington, D.C.
(AD-A086043; TSC-FAA-80-8; FAA-RD-80-53) Avail: NTIS HC A05/MF A01 CSCL 17/7

Electrical noise and interference in the LORAN-C frequency band was measured at two rural airports in Vermont and a

major airport in Boston, Mass. The purpose of the test program was to determine the potential interfering sources that could affect the proper operation of the radio navigational system, LORAN-C, when it is used for non-precision approaches and terminal and en route navigation. Although no significant interference was observed, several continuous wave transmissions were identified in the frequency band adjacent to the LORAN-C band. GRA

N80-29282# Transportation Systems Center, Cambridge, Mass.
VISUAL CONFIRMATION OF VOICE TAKEOFF CLEARANCE (VICON) ALTERNATIVE STUDY Final Report, May - Dec. 1979
Robert S. Yatsko May 1980 61 p refs Prepared for FAA, Washington, D.C.
(AD-A086080; TSC-FAA-80-2; FAA-RD-80-44) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report presents the results of a program undertaken to study potential alternatives to the VICON (Visual Confirmation of Voice Takeoff Clearance) system which has undergone operational field tests at Bradley International Airport, Windsor Locks, Connecticut since October 1979. The tests are scheduled for completion in March 1980. This report presents alternatives from two different viewpoints namely, those alternatives that can improve certain key components of the existing VICON System, and those proposing entirely different concepts than the current concept. GRA

N80-29283# Naval Weapons Center, China Lake, Calif. Weapons Dept.
STANDOFF RANGE IMPROVEMENT OF ELECTRO-OPTICAL TELEVISION GUIDANCE SYSTEMS Interim Report, period ending FY 1974
Marc L. Moulton Jan. 1980 20 p
(AD-A086197; NWC-TP-6161) Avail: NTIS HC A02/MF A01 CSCL 17/7

A technique for increasing the maximum range at which a target can be identified and acquired (standoff range) by a television electro-optical guidance system when used under hazy atmospheric conditions has been developed and flight-tested. The standoff range increase is obtained by extending and limiting the spectral response of the television camera to near infrared and incorporating electronic contrast enhancement to increase the target contrast. This method provides increased standoff range by factors from 2 to 4. GRA

N80-29284# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ACTIVE BEACON COLLISION AVOIDANCE SYSTEM TEST BED FOR 1978 LOS ANGELES FLIGHTS Progress Report, Jul. 1976 - Aug. 1978
Maurice Cohen and Charles Richardson May 1980 18 p ref
(AD-A086241; FAA-NA-79-12) Avail: NTIS HC A02/MF A01 CSCL 01/2

This document describes the test bed configuration of the Federal Aviation Administration (FAA)/air traffic control radar beacon system/Discrete Address Beacon System (ATCRBS/DABS) active mode beacon collision avoidance System (BCAS). BCAS is a ground-independent, air-to-air system activated by eliciting replies from surrounding altitude-reporting transponders within a 32 nautical mile radius. The BCAS provides a positive climb or dive command to the pilot 30 seconds prior to any possible collision. The BCAS also advises the pilot of all aircraft with marginally safe separation. Feasibility flight tests of the test bed configuration were conducted at the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, N.J., Washington, D.C., and Los Angeles, California, from 1976 through 1978. The test bed included the multilevel power interrogation capability referred to as 'whisper-shout', intended to segregate responding aircraft transponders to distribute the computer processing workload and reduce garble. GRA

N80-29285# Federal Aviation Administration, Washington, D. C. Office of Aviation Policy.
A METHOD FOR ADMINISTRATIVE ASSIGNMENT OF RUNWAY SLOTS Final Report
Kenneth E. Geisinger Jun. 1980 53 p
(AD-A086118; FAA-AVP-80-5) Avail: NTIS HC A04/MF A01 CSCL 17/7

Federal Aviation Regulations set quotas (upper limits) on the number of operations per hour at each of four major U.S. air carrier airports: Washington National, New York LaGuardia, Chicago O'Hare International and New York Kennedy International. The reservation for one of these operations is referred to as a 'runway slot'. The runway slots designated for scheduled air carriers are periodically assigned to the various carriers in advance and airline schedules are built around them. How many slots each airline gets is determined by mutual agreement among the airlines through airline scheduling committees. These committees might be abolished and their function might have to be performed by the Federal Aviation Administration (FAA). This report presents a method for administratively assigning slots to the airlines. It is based on observations made of the scheduling committees. The major difference is that in the scheduling committees, decisions are made in order to get unanimous consent; in the administrative procedure, decisions are made to maximize a measure of passenger service. GRA

N80-29286# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
PERSHING PII INERTIAL MEASUREMENT UNIT CALIBRATION TREND STUDY
H. V. White Mar. 1980 90 p
(AD-A085944; DRSMI/RG-80-20) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report presents an overview of calibration data taken from Advanced Development Program Inertial Measurement Units. Behavior of calibration parameters is examined and worst/best performers are identified. Time trends are investigated by the method of linear least squares regression. Continued surveillance of parameters, determination of the effects of ill-behaved parameters on alignment and flight performance, and minimization of time required to perform a calibration are tasks to be performed during the Engineering Development program. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-29287*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL EXPERIMENTS ON DIVERGENCE OF FORWARD-SWEPT WINGS
Rodney H. Ricketts and Robert V. Doggett, Jr. Aug. 1980 49 p refs
(NASA-TP-1685; L-13549) Avail: NTIS HC A03/MF A01 CSCL 01C

An experimental study to investigate the aeroelastic behavior of forward-swept wings was conducted in the Langley Transonic Dynamics Tunnel. Seven flat-plate models with varying aspect ratios and wing sweep angles were tested at low speeds in air. Three models having the same planform but different airfoil sections (i.e., flat-plate, conventional, and supercritical) were tested at transonic speeds in Freon 12. Linear analyses were performed to provide predictions to compare with the measured aeroelastic instabilities which include both static divergence and flutter. Six subcritical response testing techniques were formulated and evaluated at transonic speeds for accuracy in predicting static divergence. Two 'divergence stoppers' were developed and evaluated for use in protecting the model from structural damage during tests. Author

N80-29288# Aeronautical Research Labs., Melbourne (Australia).
WESSEX HELICOPTER/SONAR DYNAMICS STUDY ARL PROGRAM DESCRIPTION AND OPERATION
N. V. Williams, C. R. Guy, and N. E. Gilbert Feb. 1979 38 p refs
(ARL-Aero-Note-385; AR-001-603) Avail: NTIS HC A03/MF A01

A computer program, representing the dynamic behavior in

flight of the Wessex MK.31B helicopter and its antisubmarine warfar (ASW) sonar equipment, is described. The program is intended for operation on a PDP 10 computer and is written in CSMP 10 (ARL) simulation language. Instructions for setting up a particular simulated flight maneuver are given, together with details of program verification. Author

N80-29289# Naval Air Systems Command, Washington, D. C.
DESIGNING ON-CONDITION TASKS FOR NAVAL AIRCRAFT
1 Mar. 1980 50 p
(AD-A085450) Avail: NTIS HC A03/MF A01 CSCL 01/3

Contents: Preventive Maintenance Processes; A History of the "On Condition" Maintenance Process; A Comparison of Benefits; Non-Destructive Inspection and Testing -- Current Commercial Practice; Future Opportunities; Applications -- Structures, Powerplants, Examples; Designing an "On-Condition" Task and Measuring Results -- Designing an "On-Condition" Task, Measuring Results. GRA

N80-29290# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
MECHANICAL BEHAVIOR OF AIRFRAME MATERIALS Final Report, 1 Jan. 1976 - 31 Dec. 1979
J. A. Wert, N. E. Paton, and J. C. Chesnutt Mar. 1980 46 p refs
(Contract F44620-76-C-0025; AF Proj. 2306)
(AD-A085844; SC5053.6FR; AFOSR-80-0451TR) Avail: NTIS HC A03/MF A01 CSCL 01/3

This is the final report for a program which was initiated in 1976 to systematically evaluate the influence of hydrogen on mechanical properties of alpha titanium alloys. In the second year of the program (1977), the effort was extended to include work on the properties of fine grain aluminum alloys. Both segments of the extended program have yielded promising results which are summarized in this report. Among the more important results have been a demonstration of high sustained-load cracking rates and an acceleration of fatigue crack propagation rates by tensile hold periods in Ti-6Al containing modest amounts of hydrogen. The study of fine grain aluminum alloys has demonstrated a marked increase in exfoliation corrosion resistance in 7075 Al with fine equiaxed grain, as compared to standard commercial products. Both of these observations have important implications for the structural efficiency of Ti and Al alloys as airframe materials. GRA

N80-29291# Naval Air Development Center, Warminster, Pa. Aircraft and Crews Systems Technology Directorate.
A TIME RESPONSE APPROACH TO EQUIVALENT AIRCRAFT DYNAMICS Interim Report, Oct. 1978 - Sep. 1979
J. M. Stifel Sep. 1979 81 p refs
(WF41400000)
(AD-A085873; NADC-79231-60) Avail: NTIS HC A05/MF A01 CSCL 01/1

An analytical investigation into the basic equivalent of high-order and reduced-order aircraft dynamics is presented. The need to consider system response to inputs represented by points in the Laplace domain is explained in terms of the ability of a damped sinusoid series to the model general aperiodic pilot inputs. The region of concern in the Laplace domain is related to pilot response time by the time to the initial peak of a single damped sinusoid inputs. Several representative high-order systems and their lower order equivalents are examined for similarity of time response. A new approach for equivalent systems application is suggested based on matching time responses over the Laplace domain region. Implications of the analysis to present methods of applying equivalent systems and to suggested pilot compensation criteria are examined. The analysis leads to the conclusion that equivalent system parameters are variables dependent on Laplace domain location and that the success of current methods depend on that variation being negligible. The further conclusion is reached that if equivalent system parameters are allowed to vary, artificial time delays are unnecessary and undesirable in achieving time response similarity. GRA

N80-29292# McDonnell Aircraft Co., St. Louis, Mo.
THE EFFECTS OF GROUND WALL-JET CHARACTERISTICS ON FOUNTAIN UPWASH FLOW FORMATION AND DEVELOPMENT Final Technical Report, 15 Feb. - 15 Jun. 1980
Donald R. Kotansky and Lloyd W. Glaze 15 Jun. 1980 80 p refs
(Contract N00014-79-C-0130)
(AD-A086127; ONR-CR212-261-1F) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental program was conducted to investigate the effects of ground wall jet characteristics on two-jet fountain upwash flow formation and development. Variations in wall jet properties were generated through parametric variations in nozzle pressure ratio and jet impingement angle. Hot film anemometer measurements of the wall jet and fountain upwash flow fields resulted in the determination of fountain upwash formation momentum recovery coefficients, fountain upwash inclination and spreading characteristics, and fountain upwash mass entrainment characteristics. The data obtained in this investigation provides empirical information required for an analytical model of fountain inclination developed during this study. This analytical model is compatible with a methodology and software for the prediction of multiple jet V/STOL aircraft ground surface flow fields previously developed for the Naval Air Development Center and later modified for the NASA Ames Research Center. GRA

N80-29293# Dreyfuss-Pellman Corp., Stamford, Conn.
NON-CONTACTING ELECTRO-OPTICAL CONTOURING OF HELICOPTER ROTOR BLADES Final Report
Marc G. Dreyfuss and Arnold Pellman Dec. 1979 47 p
(Contract DAAK50-78-C-0024)
(AD-A085820) Avail: NTIS HC A03/MF A01 CSCL 01/3

Non-contact contour measurements of helicopter rotor blades to accuracies of 0.001 inch are possible via rangefinding by triangulation employing electro-optical techniques. A prototype of a portion of such a system has been built and tested. The result of these tests indicate that the construction of the full prototype system is feasible and desirable. GRA

N80-29294# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF AEROELASTIC COUPLINGS ON AEROMECHANICAL STABILITY OF A HINGELESS ROTOR HELICOPTER
William G. Bousman 1980 14 p refs Presented at the Ann. Forum of the Am. Helicopter Soc., Washington, D.C., May 1980
(AD-A085819) Avail: NTIS HC A02/MF A01 CSCL 20/4

A 1.62 m diameter rotor model was used to investigate aeromechanical stability, and the results were compared to theory. Configurations tested included: (1) a nonmatched stiffness rotor as a baseline, (2) the baseline rotor with negative pitch-lag coupling, (3) the combination of negative pitch-lag and structural flap-lag coupling on the baseline rotor, (4) a matched stiffness rotor, and (5) a matched stiffness rotor with negative pitch-lag coupling. The measured lead-lag regressing mode damping of the five configurations agreed well with theory, but only the matched stiffness case with negative pitch-lag coupling was able to stabilize the air resonance mode. Comparison of theory and experiment for the damping of the body modes showed significant differences that may be related to rotor inflow dynamics. GRA

N80-30020# Department of the Air Force, Edwards AFB, Calif. F-16 Combined Test Force.
THE OPERATIONAL ROLES OF THE F-16
Robert C. Ettinger *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 18 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30021# French Air Force, Paris. Bureau des Programmes de Materiel.
OPERATIONAL MISSIONS AND CONCEPTUAL DESIGN OF THE MIRAGE 2000
Jacques Guillou *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 5 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30022# Royal Air Force, London (England).
THE CAPABILITIES AND OPERATIONAL ROLES OF ROYAL AIR FORCE TORNADOES
H. M. Archer *In* AGARD Operational Roles, Aircraft Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-29295*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A HEAD-UP DISPLAY FORMAT FOR APPLICATION TO TRANSPORT AIRCRAFT APPROACH AND LANDING
Richard S. Bray Jul. 1980 42 p
(NASA-TM-81199; A-8180) Avail: NTIS HC A03/MF A01 CSCL 01D

A head up display (HUD) format used in simulator studies of the application of HUD to the landing of civil transport aircraft is described in detail. The display features an indication of the aircraft's instantaneous flightpath that constitutes the primary controlled element. Discrete ILS error and altitude signals are scaled and positioned to provide precise guidance modes when tracked with the flightpath symbol. Consideration is given to both the availability and nonavailability of inertial velocity information in the aircraft. Author

N80-29296# Westinghouse Research and Development Center, Pittsburgh, Pa.
MINIATURE ACTIVE MATRIX DISPLAY Final Report, 31 Dec. 1977 - 30 Jul. 1978
J. Murphy and L. J. Sienkiewicz 30 Jul. 1978 75 p
(Contract DAAK70-77-C-0140)
(AD-A085768) Avail: NTIS HC A04/MF A01 CSCL 17/2

The purpose of this research is to take a step toward the development of a miniature flat panel display system in order to replace the miniature CRT now found in Helmet Mounted Displays. This research further attempts to advance projected uses in hand-held and weapon mounted target acquisition devices. The flat panel display would result in reductions in system size, volume, weight, power, voltage and cost relative to a CRT system. In addition, new system configurations would be possible as a result of the compactness of the flat panel system. Flat displays using solid state electronics and various display media have already been developed as commercial products. In most of these, discrete light emitting or modulating elements are electronically addressed and activated. However, when high resolution is required, the large number of such elements results in difficult problems relating to element addressing, electrical connections, duty cycle, and power requirements. Over the past seven years, an intensive program at Westinghouse on the development of thin film transistor (TFT) circuits has made it possible to incorporate active circuitry within each display element, and has made it further possible to provide addressing with peripheral scanner circuitry in the same planar substrate as the display. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-29297*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING (UTW) COMPOSITE NACELLE TEST REPORT. VOLUME 2: ACOUSTIC PERFORMANCE
D. L. Stimpert Nov. 1979 124 p refs 2 Vol.
(Contract NAS3-18021)
(NASA-CR-159472; R78AEG-574-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 21E

High bypass geared turbofan engines with nacelles forming the propulsion system for short-haul passenger aircraft were tested for use in externally blown flap-type aircraft. System noise levels for a four-engine, UTW-powered aircraft operating in the powered lift mode were calculated to be 97.2 and 95.7 EPNdB at takeoff and approach, respectively, on a 152.4 m (500 ft) sideline compared to a goal of 95.0 EPNdB. A.R.H.

N80-29298*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) UNDER-THE-WING ENGINE COMPOSITE FAN BLADE: PRELIMINARY DESIGN TEST REPORT
May 1975 63 p
(Contract NAS3-18021)
(NASA-CR-134846; R75AEG411) Avail: NTIS HC A04/MF A01 CSCL 21E

Results of tests conducted on preliminary design polymeric-composite fan blade for the under the wing (UTW) OCSEE engine are presented. During this phase of the program a total of 17 preliminary OCSEE UTW composite fan blades were manufactured for various component tests including frequency characteristics, strain distribution, bench fatigue, dovetail pull, whirligig overspeed and whirligig impact. All tests were successfully completed with the exception of whirligig impact tests. Improvements in local impact capability are being evaluated for the OCSEE blade under other NASA and related programs. Author

N80-29299*# General Electric Co., Cincinnati, Ohio.
ACOUSTIC PERFORMANCE OF A 50.8-cm (20-INCH) DIAMETER VARIABLE-PITCH FAN AND INLET. VOLUME 2: ACOUSTIC DATA Final Report
K. R. Bilwakesh, A. Clemons, and D. L. Stimpert Nov. 1979 495 p refs 2 Vol.
(NASA-CR-135118; R77AEG229-Vol-2) Avail: NTIS HC A21/MF A01 CSCL 21E

Results from acoustic tests on a 50.8 cm (20 inch) QCSEE Under-the-Wing (UTW) engine, variable pitch fan and inlet simulator are tabulated. Tests were run in both forward and reverse thrust mdoes with a bellmouth inlet, five accelerating inlets (one hardwall and four treated), and four low Mach number inlets (one hardwall and three treated). The 1/3 octave-band acoustic data are presented for the model size on the measured 5.2 m (17.0 ft) arc and also data scaled to full QCSEE size 71:20 on a 152.4 m (500 ft) sideline. A.R.H.

N80-29300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT RESEARCH AND TECHNOLOGY FOR FUTURE FUELS
Jul. 1980 229 p refs Symp. held in Cleveland, Ohio, 16-17 Apr. 1980
(NASA-CP-2146; E-398) Avail: NTIS HC A11/MF A01 CSCL 21E

The potential characteristics of future aviation turbine fuels and the property effects of these fuels on propulsion system components are examined. The topics that are discussed include jet fuel supply and demand trends, the effects of refining variables on fuel properties, shekle oil processing, the characteristics of broadened property fuels, the effects of fuel property variations on combustor and fuel system performance, and combuster and fuel system technology for broadened property fuels. For individual titles, see N80-29301 through N80-29330.

N80-29301*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUTURE AVIATION FUELS OVERVIEW
Gregory M. Reck *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 1-4 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The outlook for aviation fuels through the turn of the century is briefly discussed and the general objectives of the NASA Lewis Alternative Aviation Fuels Research Project are outlined. The NASA program involves the evaluation of potential characteristics of future jet aircraft fuels, the determination of the effects of those fuels on engine and fuel system components, and the development of a component technology to use those fuels. M.G.

N80-29302*# Department of Energy, Washington, D. C.
OUTLOOK FOR ALTERNATIVE ENERGY SOURCES
Michael E. Card *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 5-9 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Predictions are made concerning the development of alternative energy sources in the light of the present national energy situation. Particular emphasis is given to the impact of alternative fuels development on aviation fuels. The future outlook for aircraft fuels is that for the near term, there possibly will be no major fuel changes, but minor specification changes may be possible if supplies decrease. In the midterm, a broad cut fuel may be used if current development efforts are successful. As synfuel production levels increase beyond the 1990's there may be some mixtures of petroleum-based and synfuel products with the possibility of some shale distillate and indirect coal liquefaction products near the year 2000. M.G.

N80-29303*# United Air Lines, Inc., Chicago, Ill.
CURRENT JET FUEL TRENDS
Paul P. Campbell In NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 11-14 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Data concerning the properties of commercial jet fuels during the period between 1974 and 1979 are discussed. During this period the average aromatics content of fuels increased from 18% to 17.5%. It is evident that the arrival of Alaska North Slope crude in 1977 had a significant impact upon the aromatics content of jet fuel supply at West Coast points with less effect upon the entire United States domestic market. This increase in aromatics has not been accompanied by a corresponding reduction in burning quality as measured by smoke point. There has been a reduction of .6 smoke point on the average. Looking at hydrogen content as a measure of burning quality, the all refinery average calculated hydrogen for 1978 was approximately 13.7%. The relationship between hydrogen content and aromatics content shows a slope of .043% reduction in hydrogen for 1% increase in aromatics. M.G.

N80-29304*# Boeing Commercial Airplane Co., Seattle, Wash.
AVIATION FUELS OUTLOOK
Albert M. Momenthy In NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 15-24 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Options for satisfying the future demand for commercial jet fuels are analyzed. It is concluded that the most effective means to this end are to attract more refiners to the jet fuel market and encourage development of processes to convert oil shale and coal to transportation fuels. Furthermore, changing the U.S. refineries fuel specification would not significantly alter jet fuel availability. M.G.

N80-29305*# *California Univ. at Los Angeles. School of* Engineering and Applied Science.
A METHODOLOGY FOR LONG-RANGE PREDICTION OF AIR TRANSPORTATION
Mohammad B. Ayati and J. Morley English *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 25-30 refs Presented at the SAE Intern. Air Transportation Meeting, Cincinnati, 20-22 May 1980 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 01C

A framework and methodology for long term projection of demand for aviation fuels is presented. The approach taken includes two basic components. The first was a new technique for establishing the socio-economic environment within which the future aviation industry is embedded. The concept utilized was a definition of an overall societal objective for the very long run future. Within a framework so defined, a set of scenarios by which the future will unfold are then written. These scenarios provide the determinants of the air transport industry operations and accordingly provide an assessment of future fuel requirements. The second part was the modeling of the industry in terms of an abstracted set of variables to represent the overall industry performance on a macro scale. The model was validated by testing the desired output variables from the model with historical data over the past decades. M.G.

N80-29306*# Exxon Research and Engineering Co., Linden, N.J.
EFFECT OF REFINING VARIABLES ON THE PROPERTIES AND COMPOSITION OF JP-5
Martin Lieberman and William F. Taylor *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 31-39 (For primary document see N80-29300 20-07)
(Contract N00140-78-C-1491)
Avail: NTIS HC A11/MF A01 CSCL 21D

Potential future problem areas that could arise from changes in the composition, properties, and potential availability of JP-5 produced in the near future are identified. Potential fuel problems concerning thermal stability, lubricity, low temperature flow, combustion, and the effect of the use of specific additives on fuel properties and performance are discussed. An assessment of available crudes and refinery capabilities is given. M.G.

N80-29307*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
FUEL/ENGINE/AIRFRAME TRADEOFF STUDY, PHASE 1
A. T. Peacock *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 41-47 Sponsored by AF (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

The effects of broadening the specifications for JP-4 and JP-8 fuels on the performance and cost of all USAF aircraft presently using JP-4 as well as those expected to be introduced into the force structure by 1983 are investigated. Test results indicated that there was no impact on engine performance, turbine durability, and coking, however there was a small maintenance cost increase as a result of a small combustor life decrease. Using JP-4 as standard fuel will avoid the use of high demand middle distillate fuels and give producers flexibility. Extensive use of JP-8 in the United States will increase middle distillate demand and cause a slight increase in engine hot-section maintenance. It is also concluded that the maximum allowable freeze point of JP-4 or JP-8 cannot be increased without degrading system performance and safety as critical conditions are approached. M.G.

N80-29308*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
MILITARY JET FUEL FROM SHALE OIL
Edward N. Coppola *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 49-57 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Investigations leading to a specification for aviation turbine fuel produced from whole crude shale oil are described. Refining methods involving hydrocracking, hydrotreating, and extraction processes are briefly examined and their production capabilities are assessed. M.G.

N80-29309*# *National Aeronautics and Space Administration.* Lewis Research Center, Cleveland, Ohio.
FUELS CHARACTERIZATION STUDIES
Gary T. Seng, Albert C. Antoine, and Francisco J. Flores *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 59-65 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Current analytical techniques used in the characterization of broadened properties fuels are briefly described. Included are liquid chromatography, gas chromatography, and nuclear magnetic resonance spectroscopy. High performance liquid chromatographic ground-type methods development is being approached from several directions, including aromatic fraction standards development and the elimination of standards through removal or partial

removal of the alkene and aromatic fractions or through the use of whole fuel refractive index values. More sensitive methods for alkene determinations using an ultraviolet-visible detector are also being pursued. Some of the more successful gas chromatographic physical property determinations for petroleum derived fuels are the distillation curve (simulated distillation), heat of combustion, hydrogen content, API gravity, viscosity, flash point, and (to a lesser extent) freezing point. M.G.

N80-29310*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMBUSTION TECHNOLOGY OVERVIEW

Richard W. Niedzwiecki *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 67-73 refs (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21B

An overview of combustor technology developments required for use of broadened property fuels in jet aircraft is presented. The intent of current investigations is to determine the extent to which fuel properties can be varied, to obtain a data base of combustion - fuel quality effects, and to determine the trade-offs associated with broadened property fuels. Subcomponents of in-service combustors such as fuel injectors and liners, as well as air distributions and stoichiometry, are being altered to determine the extent to which fuel flexibility can be extended. Finally, very advanced technology consisting of new combustor concepts is being evolved to optimize the fuel flexibility of gas turbine combustors. M.G.

N80-29311*# General Electric Co., Fairfield, Conn.

EXPERIMENTAL COMBUSTOR STUDY PROGRAM

John M. Kasper and Edward E. Ekstedt *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 75-82 (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21E

Advanced combustor concepts are evaluated as a means of accommodating possible future broad specification fuels. The three advanced double annular combustor concepts consisted of (1) a concept employing high pressure drop fuel nozzles for improved atomization, (2) a concept with premixing tubes in the main stage, and (3) a concept with the pilot stage on the inside and the main stage on the sideout, which is the reverse of the other two concepts. All of the advanced concepts show promise for reduced sensitivity to fuel hydrogen content. Some hardware problems were encountered, but these problems could be quickly resolved if refinement tests were conducted. The design with the premixing main stage was selected for a parametric test because of its low NOx emissions level, carbon free dome, and very low dome temperatures which were essentially independent of fuel type. The other advanced designs also had low dome temperatures. The premixing dome design liner temperatures exhibited less sensitivity to fuel type than did the base-line combustor, although more sensitivity than observed for concept 1. The inner liner hot spot and the observed smoke results for the premixing design suggest that the fuel-air mixture was not as uniform as desired. M.G.

N80-29312*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

FUEL CHARACTER EFFECTS ON THE J79 AND F101 ENGINE COMBUSTION SYSTEMS

Thomas A. Jackson *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 83-93 (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21E

The effects of select fuel property variations on two major engine classifications are summarized. Thirteen refined and blended fuels were used which exhibited significant variations in hydrogen content, aromatic type, initial boiling point, final boiling point, and viscosity. Trends were very similar but the degree of fuel sensitivity was not constant. For both systems the dominant fuel property during high pressure operation was found to be fuel hydrogen content. For operation at low pressure test points the fuel volatility and viscosity became the dominant fuel properties for both systems. Aromatic type and final boiling point did not significantly affect combustion data. Correlations of other fuel properties with these and other performance parameters are presented. E.D.K.

N80-29313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA BROADENED-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM

James S. Fear *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 95-98 (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21B

The broadened-Specification Fuels Combustion Technology program's purpose is to evolve and demonstrate the technology required to enable current and next generation high-thrust, high-bypass-ratio turbofan engines to use fuels with broadened properties and to verify the evolved technology in full scale engine tests. The three phases of the program are combustor concept screening, combustor optimization testing, and engine verification testing. Constraints for designing combustion systems are outlined and problems to be expected in the use of broadened properties fuels are listed. E.D.K.

N80-29314*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

AIR FORCE FUEL MAINBURNER/TURBINE EFFECTS PROGRAMS

Thomas A. Jackson *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 99-103 (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21E

A program for the determination of fuel property effects on aircraft gas turbine engine mainburners and turbines is discussed. The six engines selected as test candiates are the J79, JB5, J57, TF30, TF39, and F100. Fuels election is the responsibility of the contractors with two fuels as exceptions. The petroleum JP-4 is to be used as a baseline in all tests. The shale JP-4 is to be used in nearly all tests. Fuel properties are to be correlated with combustion system performance paramters. In addition, life predictions are to be made for combustor and turbine hardware. These predictions are to be based on a typical mission for each system, measured metal temperatures and temperature gradients, and oxidation/corrosion effects. E.D.K.

N80-29315*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

THE BROADENED-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM AT PRATT AND WHITNEY AIRCRAFT

Robert P. Lohmann *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 105-108 (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21B

The impact of the use of broadened specification fuels on combustor design was investigated. Particular emphasis was placed on establishing the viability of various combustor modifications to permit the use of broadened specification fuels while meeting exhaust emissions and performance specifications and maintaining acceptable combustor operational and durability characteristics. Three different combustor concepts will be evaluated. Various design modifications on the operating capability of each of the combustor concepts with experimental referee broadened specification Fuel. The modifications that were evaluated included perturbations of the combustor airflow schedules to alter local stoichiometry and residence time histories revisions to the fuel injectors, and variations in liner cooling including the use of thermal barrier coatings and/or advanced cooling concepts. R.C.T.

N80-29316*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

NASA/GENERAL ELECTRIC BROAD-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM, PHASE 1

Willard J. Dodds *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 109-113 (For primary document see N80-29300 20-07)

Avail: NTIS HC A11/MF A01 CSCL 21D

The use of broad specification fuels in aircraft turbine engine combustion systems was examined. Three different combustor design concepts were evaluated for their ability to use broad specification fuels while meeting several specific

emissions, performance, and durability goals. These combustor concepts covered a range from those having limited complexity and relatively low technical risk to those having high potential for achieving all of the program goals at the expense of increased technical risk. R.C.T.

N80-29317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUELS RESEARCH: COMBUSTION EFFECTS OVERVIEW
John B. Haggard, Jr. *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 115-116 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The effects of broadened property fuels on gas turbine combustors were assessed. Those physical and chemical properties of fuels that affect aviation gas turbine combustion were isolated and identified. Combustion sensitivity to variations in particular fuel properties were determined. Advanced combustion concepts and subcomponents that could lessen the effect of using broadened property fuels were also identified. R.C.T.

N80-29318*# Purdue Univ., Lafayette, Ind.
ATOMIZATION OF BROAD SPECIFICATION AIRCRAFT FUELS
J. G. Stickford and A. H. Lefebvre *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 117-124 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The atomization properties of liquid fuels for the potential use in aircraft gas turbine engines are discussed. The significance of these properties are addressed with respect to the ignition and subsequent combustion behavior of the fuel spray/air mixture. It is shown that the fuel properties which affect the atomization behavior (viscosity, surface tension, and density) are less favorable for the broad specification fuels as compared to with those for conventional fuels. R.C.T.

N80-29319*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANTIMISTING KEROSENE
Harold W. Schmidt *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 125-130 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

The antimisting additive (FM-9) was tested in terms of its propulsion systems performance. The effect of the additive on engine operation was evaluated, operating problems were identified, the adaptability of engines to antimisting kerosene was assessed, and the potential viability of this fuel for use in present and future fan jet engines was determined. R.C.T.

N80-29320*# Massachusetts Inst. of Tech., Cambridge.
SOOT FORMATION AND BURNOUT IN FLAMES
B. Prado, J. D. Bittner, K. Neoh, and J. B. Howard *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 131-137 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The amount of soot formed when burning a benzene/hexane mixture in a turbulent combustor was examined. Soot concentration profiles in the same combustor for kerosene fuel are given. The chemistry of the formation of soot precursors, the nucleation, growth and subsequent burnout of soot particles, and the effect of mixing on the previous steps were considered. R.C.T.

N80-29321*# Exxon Research and Engineering Co., Linden, N.J.
FUEL PROPERTY EFFECTS IN STIRRED COMBUSTORS
In NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 139-146 Sponsored by DOE (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

Soot formation in strongly backmixed combustion was investigated using the jet-stirred combustor (JSC). This device provided a combustion volume in which temperature and combustion were uniform. It simulated the recirculating characteristics of the gas turbine primary zone; it was in this zone where mixture conditions were sufficiently rich to produce soot. Results indicate that the JSC allows study of soot formation in an aerodynamic situation revelant to gas turbines. R.C.T.

N80-29322*# Southwest Research Inst., San Antonio, Tex.
EFFECT OF FUEL MOLECULAR STRUCTURE ON SOOT FORMATION IN GAS TURBINE COMBUSTION
D. W. Naegeli and C. A. Moses *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 147-152 (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

The effect of fuel variations at the same hydrogen content on the formation of soot in a gas turbine combustor was studied. Six fuels were burned to a combustor over a matrix of about 50 test conditions with test conditions ranging over 500-1800 kPa (5-18 atm) pressure and 500-1000 K burner inlet temperature; fuel-air ratios were varied from 0.008-0.024. Flame radiation measurements were made through a sapphire window toward the end of the primary zone. The hydrogen content of the six test fuels ranged from 12.80 to 12.88%. Five fuels emphasized hydrocarbon types: (mono, di, and tricyclic), naphthenes (decalin) and partially hydrogenated aromatics (tetralin); the sixth fuel emphasized final boiling point. R.C.T.

N80-29323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDIES OF COMBUSTOR SENSITIVITY TO ALTERNATIVE FUELS
Francis M. Humenik *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 153-160 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

Combustion problems associated with using alternative fuels ground power and aeropropulsion applications were studied. Rectangular sections designed to simulate large annular combustor test conditions were examined. The effects of using alternative fuels with reduced hydrogen content, increased aromatic content, and a broad variation in fuel property characteristics were also studied. Data of special interest were collected which include: flame radiation characteristics in the various combustor zones; the corresponding increase in liner temperature from increased radiant heat flux; the effect of fuel bound nitrogen on oxides of nitrogen (NO sub x) emissions; and the overall total effect of fuel variations on exhaust emissions. R.C.T.

N80-29324*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUELS RESEARCH: FUEL THERMAL STABILITY OVERVIEW
Stephen M. Cohen *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 161-168 ref (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21B

Alternative fuels or crude supplies are examined with respect to satisfying aviation fuel needs for the next 50 years. The thermal stability of potential future fuels is discussed and the effects of these characteristics on aircraft fuel systems are examined. Advanced fuel system technology and design guidelines for future fuels with lower thermal stability are reported. R.C.T.

N80-29325*# United Technologies Research Center, East Hartford, Conn.
EXPERIMENTAL STUDY OF TURBINE FUEL THERMAL STABILITY IN AN AIRCRAFT FUEL SYSTEM SIMULATOR
Alexander Vranos and Pierre J. Marteney *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 169-179 ref (For primary document see N80-29300 20-07)
(Contract NAS3-21593)
Avail: NTIS HC A11/MF A01 CSCL 21D

The thermal stability of aircraft gas turbines fuels was investigated. The objectives were: (1) to design and build an aircraft fuel system simulator; (2) to establish criteria for quantitative assessment of fuel thermal degradation; and (3) to measure the thermal degradation of Jet A and an alternative fuel. Accordingly, an aircraft fuel system simulator was built and the coking tendencies of Jet A and a model alternative fuel (No. 2 heating oil) were measured over a range of temperatures, pressures, flows, and fuel inlet conditions. R.C.T.

N80-29326*# Naval Air Propulsion Test Center, Trenton, N.J.
DETERMINATION OF JET FUEL THERMAL DEPOSIT RATE USING A MODIFIED JFTOT
C. J. Nowack and R. J. Dalfosso *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 181-184
(For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Three fuels having different breakpoint temperatures were studied in the modified jet fuel thermal oxidation tester. The lower stability fuel with a breakpoint of 240 C was first stressed at a constant temperature. After repeating this procedure at several different temperatures, an Arrhenius plot was drawn from the data. The correlation coefficient and the energy of activation were calculated to be 0.97 and 8 kcal/mole respectively. Two other fuels having breakpoint temperatures of 271 C and 285 C were also studied in a similar manner. A straight line was drawn through the data at a slope equivalent to the slope of the lower stability fuel. The deposit formation rates for the three fuels were determined at 260 C, and a relative deposit formation rate at this temperature was calculated and plotted as a function of the individual fuel's breakpoint temperatures.
R.C.T.

N80-29327*# Colorado School of Mines, Golden.
MECHANISMS OF NITROGEN HETEROCYCLE INFLUENCE ON TURBINE FUEL STABILITY
Stephen R. Daniel and Jonathan H. Worstell *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 185-193 (For primary document see N80-29300 20-07)
(Contract NsG-3122)
Avail: NTIS HC A11/MF A01 CSCL 21D

Lewis bases were extracted from a Utah COED syncrude via ligand exchange. Addition of this extract to Jet A at levels as low as 5 ppm N produced deterioration of stability in both JFTOT and accelerated storage tests (7 days at 394 K with 13:1 air to fuel ratio). Comparable effects on Jet A stability were obtained by addition of pyridine and quinoline, while pyrrole and indole were less detrimental at the same concentration level. The weight of deposit produced accelerated storage tests was found to be proportional to the concentration of added nitrogen compound. Over the narrow temperature range accessible with the experimental method, Arrhenius plots obtained by assuming specific rate to be proportional to the weight of material deposited in seven days exhibit greater slopes in the presence of those nitrogen compounds producing the greater deposition rates. It is shown that despite variation in appearance the elemental composition and spectral characteristics of the deposits are unaffected by addition of the nitrogen compounds. The linearity of the Arrhenius plots and of a plot of Arrhenius slope versus intercept for all the compounds suggests a constancy of mechanism over the range of temperature and heterocycles studied.
R.C.T.

N80-29328*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUEL SYSTEM TECHNOLOGY OVERVIEW
Robert Friedman *In its* Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 195-203 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21E

Fuel system research and technology studies are being conducted to investigate the correlations and interactions of aircraft fuel system design and environment with applicable characteristics of the fuel. Topics include: (1) analysis of in-flight fuel temperatures; (2) fuel systems for high freezing point fuels; (3) experimental study of low temperature pumpability; (4) full scale fuel tank simulation; and (5) rapid freezing point measurement.
E.D.K.

N80-29329*# Boeing Military Airplane Development, Seattle, Wash.
HIGH-FREEZING-POINT FUEL STUDIES
Frederick F. Tolle *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 205-219 refs (For primary document see N80-29300 20-07)
Avail: NTIS HC A11/MF A01 CSCL 21D

Considerable progress in developing the experimental and analytical techniques needed to design airplanes to accomodate fuels with less stringent low temperature specifications is reported. A computer technique for calculating fuel temperature profiles in full tanks was developed. The computer program is being extended to include the case of partially empty tanks. Ultimately, the completed package is to be incorporated into an aircraft fuel tank thermal analyser code to permit the designer to fly various thermal exposure patterns, study fuel temperatures versus time, and determine holdup.
E.D.K.

N80-29330*# Lockheed-California Co., Burbank.
LOW TEMPERATURE FUEL BEHAVIOR STUDIES
Francis J. Stockemer *In* NASA. Lewis Res. Center Aircraft Res. and Technol. for Future Fuels Jul. 1980 p 221-233 refs
(For primary document see N80-29300 20-07)
(Contract NAS3-20814)
Avail: NTIS HC A11/MF A01 CSCL 21E

Aircraft fuels at low temperatures near the freezing point. The principal objective was an improved understanding of the flowability and pumpability of the fuels in a facility that simulated the heat transfer and temperature profiles encountered during flight in the long range commercial wing tanks.
R.C.T.

N80-29331*# TRW, Inc., Cleveland, Ohio.
TUNGSTEN WIRE/FeCrAlY MATRIX TURBINE BLADE FABRICATION STUDY
P. Melnyk and J. N. Fleck Dec. 1979 99 p refs
(Contract NAS3-20391)
(NASA-CR-159788; TRW-ER-8101) Avail: NTIS HC A05/MF A01 CSCL 21E

The objective was to establish a viable FRS monotape technology base to fabricate a complex, advanced turbine blade. All elements of monotape fabrication were addressed. A new process for incorporation of the matrix, including bi-alloy matrices, was developed. Bonding, cleaning, cutting, sizing, and forming parameters were established. These monotapes were then used to fabricate a 48 ply solid JT9D-7F 1st stage turbine blade. Core technology was then developed and first a 12 ply and then a 7 ply shell hollow airfoil was fabricated. As the fabrication technology advanced, additional airfoils incorporated further elements of sophistication, by introducing in sequence bonded root blocks, cross-plying, bi-metallic matrix, tip cap, trailing edge slots, and impingement inserts.
Author

N80-29332*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF PERFORMANCE DETERIORATION OF THE CF6/JT9D, HIGH-BYPASS RATIO TURBOFAN ENGINES
Joseph A. Ziemianski and Charles M. Mehalic 1980 22 p refs Proposed for presentation at the 58th AGARD Propulsion and Energetics Symp. on Turbine Engine Testing, Turin, 29 Sep. - 3 Oct. 1980 and SAE Aerospace Congr., Los Angeles, 13-16 Oct. 1980
(NASA-TM-81552; E-511) Avail: NTIS HC A02/MF A01 CSCL 21E

The aircraft energy efficiency program within NASA is developing technology required to improve the fuel efficiency of commercial subsonic transport aricraft. One segment of this program includes engine diagnostics which is directed toward determining the sources and causes of performance deterioration in the Pratt and Whitney Aircraft JT9D and General Electric CF6 high-bypass ratio turbofan engines and developing technology for minimizing the performance losses. Results of engine performance deterioration investigations based on historical data, special engine tests, and specific tests to define the influence of flight loads and component clearances on performance are presented. The results of analysis of several damage mechanisms that contribute to performance deterioration such as blade tip rubs, airfoil surface roughness and erosion, and thermal distortion are also included. The significance of these damage mechanisms on component and overall engine performance is discussed.
A.R.H.

N80-29333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF THE WARM CORE TURBINE FACILITY RECENTLY INSTALLED AT NASA LEWIS RESEARCH CENTER

W. J. Whitney, R. G. Stabe, and T. P. Moffitt 1980 18 p refs Proposed for presentation at Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by Am. Soc. of Automotive Engrs. (NASA-TM-81562; E-524) Avail: NTIS HC A02/MF A01 CSCL 21E

The two net facilities were installed and operated at their design, or rated conditions. The important feature of both of these facilities is that the ratio of turbine inlet temperature to coolant temperature encountered in high temperature engines can be duplicated at moderate turbine inlet temperature. The limits of the facilities with regard to maximum temperature, maximum pressure, maximum mass flow rate, turbine size, and dynamometer torque-speed characteristics are discussed. Author

N80-29334# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

NOISE SUPPRESSION IN JET INLETS Final Technical Report, 1 Feb. 1979 - 31 Jan. 1980

Ben T. Zinn, William L. Meyer, and Brady R. Daniel Feb. 1980 57 p refs

(Contract F49620-77-C-0066; AF Proj. 2307)

(AD-A085403; AFOSR-80-0452TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

This research program was concerned with the development of an analytical technique, based on an integral representation of the external solutions of the Helmholtz equation, for the prediction of the sound radiated from complicated, acoustically lined, axisymmetric bodies having complex sound sources. The purpose of this research program was to generate efficient computer codes for the prediction of the sound radiated from acoustically lined jet engine inlets. In the experimental tests two geometrical configurations were studied, a straight duct and a jet engine inlet. Both of these configurations were tested with hard walls and the straight duct was tested with an acoustic liner consisting of a matrix of Helmholtz resonators. It was found that very good agreement was obtained for the hard walled configurations while there were some discrepancies with the lined wall case. It is conjectured that this discrepancy in some of the lined wall results is mainly due to the particular liner theory used to calculate the effective admittance of the liner. GRA

N80-29335# Solar Turbines International, San Diego, Calif.

COMPLEX, PRECISION CAST COLUMBIUM ALLOY GAS TURBINE ENGINE NOZZLES COATED TO RESIST OXIDATION Final Report, 2 Aug. 1976 - 2 Aug. 1979

Lulu Hsu and W. G. Stevens Apr. 1980 144 p refs

(Contract DAAG46-76-C-0053)

(AD-A086128; SR80-R-4444-25; USAAVRADCOM-TR-80-F-2) Avail: NTIS HC A07/MF A01 CSCL 11/6

The objectives of this program were to produce investment cast single vane nozzle segments in C129Y alloy (NB-10HF-10W-0.3Y) and to coat these vanes with the NS-4 (50W-20Mo-15Ti-10V) silicide coating. Initially, both cored and solid vane segments were specified but due to problems experienced in the consumable arc process, cored vanes were deleted from the program scope. Several problems developed. The electrode material supplied was low in yttrium, which might have contributed to the poor fluidity during arc melt and incomplete fill of thin walled sections. The solid nozzles and round test bars were acceptable and were used in coating processing and testing. Process specifications for both slurry spray and dip applications of the NS-4 modifier were prepared. Tensile and stress rupture tests of coated specimens displayed exceptional properties at elevated temperatures and showed superiority to cobalt-base vane alloys. Isothermal oxidation lives in excess of 5500 hours (at 760 and 1093 C) were exhibited by NS-4 coated C129Y specimens. In rig testing, under the severe thermal cycles and profiles imposed, the airfoil specimens typically survived about 100 Hours. GRA

N80-29336# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

F101 CENTRAL INTEGRATED TEST SUBSYSTEM EVALUATION Final Technical Report, 2 Apr. - 31 Dec. 1979

C. T. Vincent and C. A. Arulf Feb. 1980 137 p

(Contract F33615-79-C-2022; AF Proj. 3066)

(AD-A086130; R79AEG622; AFWAL-TR-80-2002) Avail: NTIS HC A07/MF A01 CSCL 21/5

Existing B-1/F101 flight data were used to determine the technical application and results of the diagnostic and monitoring systems utilized in the CITS. Contractor's analyses performed in support of the B-1 program provide the starting point for this program. The CTIS functions investigated were (1) fault detection and isolation, (2) flight readiness status, (3) LCF and time at temperature counting, and (4) trend data acquisition. The data evaluation had four objectives: (1) Determine how well the B-1/F101 diagnostic and monitoring requirements/goals were met; (2) establish the rates of false indication; (3) categorize the maintenance actions taken on the basis of CITS inputs; and (4) determine the effectiveness of the trending program. In addition, the effectiveness of the F101 CITS parameter and data sampling rates was determined. Continuous recorded CITS data were used to evaluate usage tracking parameters and their effectiveness in determining maintenance actions. GRA

N80-29337# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.

NUMERICAL STUDIES OF THE RADIATION CONDITION AT THE INLET OF A TRANSONIC COMPRESSOR BLADE ROW Final Report, 28 Oct. 1978 - 25 Feb. 1980

William J. Rae and Gregory F. Homicz Apr. 1980 37 p refs

(Contract N00019-78-C-0603)

(AD-A085978; CALSPAN-6432-A-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

Finite-difference calculations of the flow in a transonic compressor blade row were carried out, using a radiation boundary condition at a plane upstream of the blades. These results show essentially no difference from a comparable set that were done using a uniform-flow approximation as the inlet boundary condition. GRA

N80-29338# ARO, Inc., Arnold Air Force Station, Tenn.

FLOW QUALITY FOR TURBINE ENGINE LOADS SIMULATOR (TELS) FACILITY Final Report, 1 Oct. 1978 - 1 Sep. 1979

R. J. Schulz Jun. 1980 38 p refs

(AD-A086084; AEDC-TR-79-83) Avail: NTIS HC A03/MF A01 CSCL 21/5

A study was made to define the flow quality in air inlets used to support engine testing in the proposed Turbine Engine Loads Simulator Facility (TELS). The study showed that inlets could be designed that would produce separation-free flow for the worst case of crossflow induced by TELS rotation. The severity of recirculated exhaust gas ingestion by the inlet was estimated using a finite-difference numerical simulation of the engine and its exhaust deflector. Finally, a method was devised for defining the performance of a representative engine, the Pratt and Whitney F100 engine. The possible effects of inlet flow nonuniformity on engine performance in TELS were detailed. GRA

N80-29339# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.

SOFT BODY IMPACT OF CANTILEVER BEAMS Interim Technical Report, Oct. 1977 - Jul. 1979

Jeffry D. Sharp Mar. 1980 76 p refs

(AF Proj. 2418)

(AD-A086049; AFML-TR-79-4169) Avail: NTIS HC A05/MF A01 CSCL 21/5

Damage incurred by gas turbine engine fan blades due to foreign object ingestion is of great concern to both manufacturers and the agencies that purchase such products. Of particular interest is the response of a structure impacted by a soft body, such as a bird. As a result, efforts have been made in the last several years to understand the dynamic behavior of blade-like structures under impact loading. A great deal of information is available concerning the hard body impact problem. However, the soft body impact problem has not yet been investigated as thoroughly. This study experimentally and analytically investigates the stress/time response of a cantilever beam subjected to impact loading from a soft object. Results from several different analytical models employing the Euler-Bernoulli Beam Theory are compared to experimental data, and the validity of each model is assessed. The effects of structural damping, beam dimensions and the Timoshenko Theory parameters are discussed and conclusions as to their importance are drawn. It was determined that a cantilever beam impacted by a soft body can be accurately

modeled as a forced vibration problem using the Euler-Bernoulli Theory and linear modal analysis with damping. In addition, it was shown that large structures can be linearly scaled down for impact testing without affecting the results. GRA

N80-29340# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT OF A NONINTERFERENCE TECHNIQUE FOR MEASUREMENT OF TURBINE ENGINE COMPRESSOR BLADE STRESS Final Report, 1 Jul. 1976 - 30 Dec. 1978
P. E. McCarty and J. W. Thompson, Jr. AEDC Jun. 1980 47 p refs
(AD-A086170; AEDC-TR-79-78) Avail: NTIS HC A03/MF A01 CSCL 21/5

A noninterference technique for measuring stress in compressor blades of turbine engines is being developed to alleviate disadvantages associated with conventional strain-gage measurement systems. This technique utilizes blade tip deflection measurements and special data processing algorithms to infer local blade stress. A prototype noninterference processing system for inferring blade stress from a single compressor stage, from blade vibrations nonintegral to engine speed has been developed. Blade stress amplitude and spectral information are displayed on conventional strain-gage-type displays with which the blade stress analyst is intimately familiar. The prototype system has been checked by comparison with existing recorded strain-gage test data sampled to simulate blade tip deflection measurements. GRA

N80-29341*# National Materials Advisory Board, Washington, D. C.
RELIABILITY OF CERAMICS FOR HEAT ENGINE APPLICATIONS Final Report
1980 151 p refs Sponsored in part by NASA
(Contract MDA903-78-C-0038)
(NASA-CR-163435; PB80-182678; NMAB-357) Avail: NTIS HC A08/MF A01 CSCL 21E

The advantages and disadvantages associated with the use of monolithic ceramics in heat engines are discussed. The principle gaps in the state of understanding of ceramic material, failure origins, nondestructive tests as well as life prediction are included. R.C.T.

N80-29342# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CERAMICS FOR TURBINE ENGINE APPLICATIONS
Mar. 1980 353 p refs In ENGLISH; partly in FRENCH Presented at the 49th Meeting of the AGARD Struct. and Mater. Panel, Cologne, 8-10 Oct. 1979
(AGARD-CP-276; ISBN-92-835-0261-2) Avail: NTIS HC A16/MF A01

Advances in high temperature materials technology and/or the design and fabrication approaches to use them to increase the performance or durability, or to reduce the cost of turbine engines are assessed. One specific approach investigated involves high temperature ceramics and the associated design technology for using brittle materials in automobile engines and electric power generators. The design, fabrication, and testing of actual components are reported and the results are evaluated for aerospace applications. For individual titles, see N80-29343 through N80-29366.

N80-29343# General Electric Co., Lynn, Mass. Aircraft Engine Group.
BENEFITS OF CERAMICS TO GAS TURBINES
Arnold Brooks and Albert I. Bellin *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 25 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The potential areas of benefit of structural ceramics in advanced propulsion engines for manned and short-life, unmanned aircraft applications are addressed. Ceramic characteristics such as rupture strength, creep, oxidation and corrosion are viewed in the perspective of advanced metal alloys. For various engine elements, operating regimes are indicated in which ceramics are anticipated to have benefits over metal parts. Considerations of cooling requirements, contours and tolerances, clearances and contacts, inspection and proof tests are discussed and their impact on engine performance, durability, and cost are assessed. For parts such as turbine blades and vanes, bearings, combustors and flame-holders, establishment of benefit for ceramics is dependent upon the engine size. An example is presented for a ceramic turbine blade which shows that for conventional scaling, the probability of part survival decreases as engine size increases due to the brittle, statistical, volume dependent characteristics of the material. In general, as engine size increases, the design approaches and the degree of benefit for various ceramic parts will be modified and/or a size limit will be reached. Within the ceramic payoff regime, low cost relative to metal parts is anticipated to be a significant benefit. J.M.S.

N80-29344# Army Materials and Mechanics Research Center, Watertown, Mass.
CERAMICS FOR SMALL AIRBORNE ENGINE APPLICATIONS
R. Nathan Katz and Edward M. Lenoe *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 13 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The likelihood for successful application of ceramics to several classes of airborne engines with different duty cycles is assessed. The general design criteria and associated key materials and requirements for generic engines for limited, APU, and man-rate helicopter use are addressed. Materials, processes, design approaches, and reliability considerations appropriate to each generic engine category are briefly discussed. A scenario for a least risk strategy for the introduction of ceramics into airborne engines will presented. Key issues in materials research and development are identified. J.M.S.

N80-29345# Noel Penny Turbines Ltd., Toll Bar End (England). Engineering Analysis Dept.
REQUIREMENTS FOR MATERIALS FOR LAND VEHICLE GAS TURBINES
D. F. Moss *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 11 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The requirements for land-vehicle power plants are discussed. It is shown how engine concepts and working cycles are being developed, and how improvements in materials will contribute to making the gas turbine a major competitor in this field. J.M.S.

N80-29346# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TECHNOLOGIES FOR USE OF CERAMICS IN TURBOENGINES
Serge Boundigues and Georges Fratacci (Direction des Recherches, Etude et Techniques, Paris) *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 13 p In FRENCH; ENGLISH summary (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The problems raised by the introduction of ceramics in aircraft engines are discussed from two view points, adaptation of technological solutions used for metals, and concept of aerodynamics and turbine technology adapted to ceramic materials. After an aerothermodynamic justification of the contrarotative solutions proposed, several formulas of turbines integrated in a complete engine are presented. The aerodynamic loads, temperature, stresses, batch fabrication, and fixation on the disc circumference are determined for the blades. The stress level, the possibility of fretting with fibers, and the thermal insulation are determined for the discs. Ideas on the adaptation of the classical formulas to ceramics are presented along with, in particular, a technique reducing pressure losses upstream and downstream of a ceramics heat exchanger. J.M.S.

N80-29347# AiResearch Mfg. Co., Phoenix, Ariz.
SILICON NITRIDE TURBINE BLADE DEVELOPMENT
F. Blake Wallace, John E. Harper, Carl R. Dins, David W. Richerson, and Harry L. Kington *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 12 p (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Hot-pressed silicon nitride (HPSN) rotor blades were developed as part of a two stage turbine. Program activities are described including design optimization to minimize steady-state

and vibratory stress, material characterization, attachment tests, manufacturing process development, inspection, proof tests, turbine-rig development, and engine tests. This program demonstrates for the first time that ceramics can withstand the severe environment imposed on gas turbine rotating components, and that the potential for engines with increased efficiency and decreased use of strategic materials can be realized. J.M.S.

N80-29348# Ford Motor Co., Dearborn, Mich. Engineer and Research Staff.
DUO-DENSITY CERAMIC TURBINE ROTOR: CONCEPTS, MATERIALS PROCESSES AND TEST RESULTS
R. R. Baker and A. F. McLean *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 19 p refs Sponsored in part by DARPA, DOE and Army Materials and Mechanics Research Center (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The duo-density ceramic turbine rotor concept utilizes the high strength of hot pressed silicon nitride in the simple-shaped hub and adequately high strength of reaction bonded silicon nitride for the complex-shaped blades which can be readily formed by injection molding or slip casting. Design concepts, materials and fabrication process for making duo-density rotors are presented including recent developments in Ford's hot press/press bonding process. Background and status of the Ford/DARPA rotor testing program is presented including cold spin test and hot spin test results on duo-density rotors. Recommendations are presented for follow-on work. Author

N80-29349# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
DEVELOPMENT OF AN INTEGRAL CERAMIC BLADE-METAL DISK WITH CIRCUMFERENTIAL BLADE ATTACHMENT
S. A. McLeod, B. H. Walker, and M. I. Mendelson *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 10 p refs Sponsored by DARPA (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The development of a hybrid turbine rotor by attaching hot-pressed Si3N4 airfoils to a wrought AF2-1DA superalloy disk using the GATORIZING forging process is summarized. An approach for fabricating low cost ceramic airfoils (platformless blades) is discussed. The ceramic blade rotors were hot spin tested at 750 rev/s (45,000 rpm) and 1505 K blade temperature, which were representative of small gas turbine engine conditions. J.M.S.

N80-29350# Daimler-Benz A. G., Stuttgart (West Germany).
INVESTIGATIONS OF A HOT-PRESSED SILICON NITRIDE TURBINE ROTOR
Eberhard Tiefenbacher *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 9 p (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The development of turbine wheels consisting of hot-pressed silicon nitride is reported. The preliminary tests carried out to examine the thermal shock characteristics of hot-pressed silicon nitride are described. An explantation of the aerodynamic design and calculation of the turbine wheel is included. Reference is also made to turbine wheel manufacturing and the results of tests carried out so far. J.M.S.

N80-29351# Naval Air Systems Command, Washington, D. C. Materials and Processes Branch
CERAMICS IN ROLLING ELEMENT BEARINGS
Charles F. Bersch *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 6 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The feasibility of using hot pressed silicon nitride (HPSN) for rolling elements and for races in ball bearings and roller bearings is explored. The HPSN offers opportunities to alleviate many current bearing problems including DN and fatigue life limitations, lubricant and cooling system deficiencies, and extreme environment demands. The history of ceramic bearings and the results of various element tests, bearing tests in rigs and bearing tests in a turbine engine are reviewed. The advantages and problems associated with the use of HPSN in rolling element bearings are discussed. Author

N80-29352# United Kingdom Atomic Energy Authority, Springfields (England). Springfields Nuclear Power Development Labs.
THE FABRICATION AND PROPERTIES OF REFEL SILICON CARBIDE IN RELATION TO GAS TURBINE COMPONENTS
P. Kennedy *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 13 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The REFEL silicon carbide was developed as a canning material for high temperature nuclear reactor fuel, because of its high temperature stability, its oxidation resistance and its thermal stress and thermal shock resistance, and the reliability of the manufacturing process and the consistency of the product were established at an early stage in the development. The gas turbine engine is analogous to the nuclear reactor in that the same material characteristics are required and fabrication processes have now been developed which enable most gas turbine components to be formed from REFEL silicon carbide effectively and with a minimum of machining. The material is shown to peform satisfactorily in most stator applications and to be superior to other available ceramic materials for combustors. In the properties of REFEL silicon carbide are discussed, the fabrication processes are outlined and some of the published test data is reviewed. J.M.S.

N80-29353# Westinghouse Research and Development Center, Pittsburgh, Pa.
STATIONARY CERAMIC COMPONENT CONSIDERATIONS FOR LARGE INDUSTRIAL COMBUSTION TURBINES
R. J. Bratton and K. L. Rieke (Westinghouse Combustion Turbine Systems Div., Concordville, Pa.) *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 8 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Major R&D efforts underway in the United States to improve the performance of industrial combustion turbines are reviewed. The major goals are improved system reliability, capability for fuel flexibility and reduced emissions. Other goals desired are improved efficiency and decreased equipment cost. Design studies have shown that significant performance advantages can be achieved if ceramics can be made to perform reliably. Since stationary ceramic components are likely to find first application in industrial turbine systems, initial efforts will be directed to their development. For the near term, the development of a low emission combustion system that meets regulations for industrial turbines burning heavy fuels has a high priority. Hot-wall combustion systems to help meet the desired performance goals are considered. J.M.S.

N80-29354# Solar Turbines International, San Diego, Calif.
DEVELOPMENT OF CERAMIC NOZZLE SECTION FOR SMALL RADIAL GAS TURBINE
J. C. Napier and J. P. Arnold *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 10 p refs Prepared in cooperation with Army Mobility Equipment Research and Development Command, Ft. Belvoir, Va. (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Ceramics not only offer improved gas turbine performance through higher turbine inlet temperature but can increase engine life because of improved hot and erosion resistance. Development work leading to engine test of both erosion-resistant and high temperature ceramic nozzle concepts is described. The first nozzle concept employs ceramic vane sections and demonstrated a ten to one-hundred fold hot end life improvement under erosive conditions in engine tests. The second concept was engine demonstrated and offers high erosion resistance as well as the capability of operating at elevated turbine inlet temperatures. Work on ceramics manufacturing methods for cost reduction with the goal of providing economic incentives for ceramics in production turbines is described. Author

N80-29355# Volkswagen A.G., Wolfsburg (West Germany). Research and Development Div.

DEVELOPMENT OF A CERAMIC TURBINE NOZZLE RING
H. Burfeindt, M. Langer, and P. M. Stuart (PMS Analysis AG, Zurich) *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 8 p refs Sponsored in part by The German Ministry of Science and Technology (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The way in which experimental testing and finite element design analysis have contributed to the understanding of the special problems associated with the use of ceramic materials in a turbine nozzle is described. During the design analysis two problem areas, the shrouds and the trailing edge, were immediately revealed. The design of an optimized nozzle ring resulted in a reduction of the high stresses in these two areas down to a level acceptable for ceramic materials currently available such as silicon nitride or silicon carbide. E.D.K.

N80-29356# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
DEVELOPMENT OF COMBUSTORS OF CERAMIC MATERIALS
G. Kappler, G. Langel, and L. Schindhelm *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 12 p refs Sponsored in part by The German State Dept. for Research and Technology (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Following early feasibility tests of various ceramic materials in hot environments, a research program was initiated to develop ceramic combustors for gas turbine applications. The design of the first ceramic combustors was based on experience with metallic flame tubes. Since test results showed that conventionally designed cylindrical combustors fracture during steady operating conditions at combustor exit temperatures above 1000 K, conical flame tubes were developed. Conical combustors which are more suited to ceramic material requirements were manufactured from Si3N4 and siliconized SiC and subjected to cyclic tests. The test results and their evaluation are reviewed. Combustors made from hot pressed silicon carbide have completed long duration cyclic tests at chamber pressures of 4.9 bar, the cyclic temperature variation adjusted at the combustor outlet being 1065 K to 1355 K. A combustor flame tube was installed in a vehicular gas turbine engine operating at 1250 K turbine inlet temperature to improve the technology of ceramic combustor design and to gain experience with ceramic combustor behavior. E.D.K.

N80-29357# Lucas Aerospace Ltd., Burnley (England). Fabrications Dept.
SOME EXPERIENCE IN THE DESIGN AND EVALUATION OF CERAMIC COMBUSTION CHAMBERS
G. Sedgwick *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 15 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The design, component evaluation, and combustion testing of a small reverse flow annular combustion chamber constructed in silicon nitride is reviewed. Initially heat transfer assessments were made of the temperature levels which components would reach during combustion testing and a thermal test program was formulated which enabled loadings well in excess of those estimated for the actual flame tube environment to be imposed upon specimen components. From calculated thermal stresses, values for the probabilities of survival were obtained using a brittle failure analysis based on a Weibull distribution and a volume flow weakest link hypothesis. A subsequent program of combustion tests carried out on a pressure rig culminated in operation at a chamber exit temperature of 1762 K. A pipe combustion chamber program is also described using a monolithic construction in silicon carbide, in which failure modes are presented and analyzed. E.D.K.

N80-29358*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATE-OF-THE-ART SiAlON MATERIALS
Sunil Dutta *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 15 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The state of the art of SiAlONs is examined. The review includes work on phase relations, crystal structure, synthesis, fabrication, and properties of various SiAlONs. The essential features of compositions, fabrication methods, and microstructure are reviewed. High temperature flexure strength, creep, fracture toughness, oxidation, and thermal shock resistance are discussed. These data are compared to those for some currently produced silicon nitride ceramics to assess the potential of SiAlON materials for use in advanced gas turbine engines. E.D.K.

N80-29359# Annawerk Keramische Betriebe G.m.b.H., Roedental (West Germany). Ceranox Div.
PRESSURELESS SINTERING OF SILICON CARBIDE
Ernst Gugel and Gerhard Leimer *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 16 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The stage of development of silicon carbide is reported with respect to the parameters influencing the sintering process, the properties achieved and the forming possibilities for gas turbine components. A comprehensive literature survey is attached. E.D.K.

N80-29360# Allmanna Svenska Elektriska A. B., Robertsfors (Sweden). High Pressure Lab.
HIP SILICON NITRIDE
Hans T. Larker *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 4 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Hot isostatic pressing (HIP) is being developed as a manufacturing process for intricately shaped fully dense silicon nitride parts. The process promises to combine the most attractive features of both the reaction bonding and the hot pressing processes. An encapsulation system compatible with silicon nitride under the HIP conditions was developed. Hubs with protruding blades and airfoils with trailing edges as thin as 0.3 mm were made. It is considered feasible to develop the process to high production and to attractive processing costs. E.D.K.

N80-29361# California Univ., Berkeley. Materials Science and Mineral Engineering.
NONDESTRUCTIVE FAILURE PREDICTION IN CERAMICS
A. G. Evans *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 20 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The prediction of failure of a ceramic component can be made using nondestructive methods for detecting and characterizing the fracture critical defects. The accept/reject decision based on the nondestructive measurement requires a probabilistic analysis of both the measurement and fracture processes. The general approach for quantitative failure prediction in ceramics using nondestructive methods of defect characterization is described. The current state of knowledge as it impinges on the quantitative failure prediction issue is reviewed. E.D.K.

N80-29362# General Electric Co., Schenectady, N. Y. Ceramics Branch
FRACTURE STATISTICS DESIGN AND APPLICATION
C. A. Johnson *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 16 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The use of ceramics for load bearing structural components requires a detailed understanding of the variability in flaw size and the resulting scatter and size dependence of fracture strength. The quantitative description of these effects is known as fracture statistics. Distribution functions approximating the fracture behavior of brittle materials are discussed with emphasis on the Weibull distribution. In the application of fracture statistics as an aid for design of structural components, several factors may introduce errors in the resulting failure analysis. One such source of error, the presence of multiple flaw distributions, is discussed and illustrated. Author

N80-29363# Admiralty Marine Technology Establishment, Holton Heath (England).
REACTION-BONDED, SiAlON AND CVD Si3N4 CERAMICS FOR ENGINEERING APPLICATIONS
D. J. Godfrey *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 6 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

Recent developments in the development of reaction bonded (RBSN), chemical vapor deposited, and SiAlON and related silicon nitride ceramics are reviewed in relation to their possible application in engines. Factors which affect the strength of RBSN include nitriding conditions, powder size, and reaction promoting impurities. Significant variations in thermal conductivity have been observed. Oxidative degradation of strength can be serious and oxide impregnation can reduce it. Chemical vapor deposited Si3N4 materials had disappointing strengths and were difficult to apply thickly over large areas, although recently progress was made. Basic scientific research on SiAlON and related materials has continued to elucidate their often complex nature, but recent activity has concentrated successfully on the metal cutting and processing applications of sintered SiAlONs, rather than optimizing them for engine applications. E.D.K.

N80-29364# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Bauweisen- und Konstruktionsforschung.
COMPRESSION LOADED CERAMIC TURBINE ROTOR
R. Kochendoerfer *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 19 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The most attractive properties of fiber reinforced materials, high strength to density ratio combined with high stiffness to density ratio, can be utilized with maximum benefit. However, this group of materials does not allow high temperature application. Therefore, in the proposed design the center core of the turbine wheel which is exposed to the hot gas flow is surrounded by a concentrical cooling ring, both kept under compression up to the design speed by a composite ring combination. Cold spin test results of fiber reinforced rings made of carbon epoxy, boron aluminum, and carbon/carbon are presented as well as cold spin test results of a possible wheel/shaft connection and of compression loaded rotors. E.D.K.

N80-29365# Politecnico di Milano (Italy).
OXIDATION AND HOT CORROSION BEHAVIOR OF SINTERED NITROGEN CERAMICS
P. L. Cavallotti, N. Ducati, and P. C. Martinengo *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 8 p refs Prepared in cooperation with Fiat Research Center, Turin (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

A preliminary study on oxidation and corrosion of some types of nitrogen ceramics based on hot pressed (HPSN), reaction bonded (RBSN), reaction bonded and sintered (RBSSN), and pressu sless sintered (PSSN) compacts was completed. These materials were also tested in the presence of contaminants on the temperature range of 1170 to 1470 K. The gravimetric results indicate a more highly qualified resistance of RBSSN when compared with RBSN and PSSN samples; HPSN samples are corroded at somewhat lower rates possibly as a result of the very high density of the samples. E.D.K.

N80-29366# Fiat Research Center, Turin (Italy).
DEVELOPMENT IN SINTERED SILICON NITRIDE
E. Campo and P. C. Martinengo *In* AGARD Ceram. for Turbine Eng. Appl. Mar. 1980 8 p refs (For primary document see N80-29342 20-07)
Avail: NTIS HC A16/MF A01

The most attractive process for Si3N4 production, to avoid the reaction bonding and hot pressing problems, would be one which enables high performance and complexity of shape simultaneously. A pressureless sintering process was studied and developed, and various grades of Si3N4 were produced. Sintering aids employed for commercial Si3N4 powders and also to sinter reaction bonded silicon nitride were MgO and Y2O3. The process and the characterization of these sintered Si3N4 materials particularly in respect to structure and mechanical properties are described. E.D.K.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-29367*# Grumman Aerospace Corp., Bethpage, N.Y.
ROCKETS FOR SPIN RECOVERY
R. D. Whipple Aug. 1980 70 p refs
(Contract NAS1-15348)
(NASA-CR-159240) Avail: NTIS HC A04/MF A01 CSCL 01C

The potential effectiveness of rockets as an auxiliary means for an aircraft to effect recovery from spins was investigated. The advances in rocket technology produced by the space effort suggested that currently available systems might obviate many of the problems encountered in earlier rocket systems. A modern fighter configuration known to exhibit a flat spin mode was selected. An analytical study was made of the thrust requirements for a rocket spin recovery system for the subject configuration. These results were then applied to a preliminary systems study of rocket components appropriate to the problem. Subsequent spin tunnel tests were run to evaluate the analytical results. R.K.G.

N80-29368*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATOR RESULTS OF AN F-14A AIRPLANE UTILIZING AN AILERON-RUDDER INTERCONNECT DURING CARRIER APPROACHES AND LANDINGS Progress Report, Jan. 1979 - Feb. 1980
Wendell W. Kelly and Philip W. Brown May 1980 92 p refs
(NASA-TM-81833) Avail: NTIS HC A05/MF A01 CSCL 01C

A piloted simulator study was conducted to evaluate an aileron rudder interconnect (ARI) control system for the F-14A airplane in the landing configuration. Effects on pilot performance and handling characteristics were investigated. Two ARI configurations were tested and compared to the standard F-14 fleet control system. A nonlinear aerodynamic model of the F-14 was used in conjunction with a six degree of freedom motion base simulator. The evaluation task, which utilized three subject pilots, consistent of a night carrier approach and landing. Both ARI configurations produced improved pilot performance and pilot ratings when compared to the standard control system. Sideslip due to adverse yaw as considerably reduced by the ARI systems and heading control was more stable and precise. Lateral deviation from centerline was reduced during the approach and lateral touchdown dispersion on the carrier deck was reduced with the ARI control systems. Author

N80-29369*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SINGLE-STAGE ELECTROHYDRAULIC SERVOSYSTEM FOR ACTUATING ON AIRFLOW VALVE WITH FREQUENCIES TO 500 HERTZ
John A. Webb, Jr., Oral Mehmed, and Carl F. Lorenzo Aug. 1980 35 p refs
(NASA-TP-1678; E-252) Avail: NTIS HC A03/MF A01 CSCL 01C

An airflow valve and its electrohydraulic actuation servosystem are described. The servosystem uses a high-power, single-stage servovalve to obtain a dynamic response beyond that of systems designed with conventional two-stage servovalves. The electro-hydraulic servosystem is analyzed and the limitations imposed on system performance by such nonlinearities as signal saturations and power limitations are discussed. Descriptions of the mechanical design concepts and developmental considerations are included. Dynamic data, in the form of sweep-frequency test results, are presented and comparison with analytical results obtained with an analog computer model is made. R.K.G.

N80-29370# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.
RESULTS OF A SIMULATOR INVESTIGATION OF CONTROL SYSTEM AND DISPLAY VARIATIONS FOR AN ATTACK HELICOPTER MISSION

Edwin W. Aiken and Robert K. Merrill May 1980 25 p refs Presented at 36th Ann. Natl. Forum of the AHS, Washington, D.C., May 1980
(AD-A085812) Avail: NTIS HC A02/MF A01 CSCL 01/2

A piloted simulator experiment designed to assess the effects on overall system performance and pilot workload of variations in control system characteristics and display format and logic for a nighttime attack helicopter mission is described. The simulation facility provided a representation of a helmet-mounted display image consisting of flight-control and fire-control symbology superimposed on the background video from a simulated forward-looking infrared sensor. Control systems ranging from the baseline stability and control augmentation system to various hover augmentation schemes were investigated together with variations in the format and logic of the superimposed symbology. Selected control system and display failures were also simulated. The results of the experiment indicate that the baseline control/display system is unsatisfactory without improvement for the evaluation task which included a hovering target search and acquisition. Significant improvements in pilot rating were achieved by both control system and display variations. GRA

N80-29371# Rockwell International Corp., Anaheim, Calif. Autonetics Strategic Systems Div.
FEASIBILITY STUDY B-1 POWER CONTROLLER Final Report, Aug. - Nov. 1979
C. E. Young Warminster, Pa. NADC Nov. 1979 95 p
(Contract N62269-79-C-0294)
(AD-A086166; NADC-79134-60) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report documents the feasibility of modifying and repackaging the Solid State Power Controller (SSPC) developed for the B-1 to meet the performance and configuration requirements for Advanced Aircraft Electrical System (AAES). The effort included an analysis of the applicability of the B-1 monolithic and pass elements, and the application of advance developments to meet the volumetric constraints of NADC-30-TS-7602. GRA

N80-29372# Naval Postgraduate School, Monterey, Calif.
A METHODOLOGY FOR DETERMINING COMMAND, CONTROL, AND COMMUNICATIONS (C3) REQUIREMENTS FOR REMOTELY PILOTED VEHICLES (RPVs) AND UNMANNED DRONE AIRCRAFT M.S. Thesis
John Harvey Newton Mar. 1980 70 p refs
(AD-A085927) Avail: NTIS HC A04/MF A01 CSCL 17/2

This work describes and illustrates a method for determining command, control, and communications (C3) requirements for remotely piloted aircraft (RPA). The effort was limited to airborne platforms and investigation of the following issues: manned versus unmanned aircraft; unmanned aircraft as RECON/DESIGNATION platform; unmanned aircraft as weapon delivery platform; C3 requirements for unmanned aircraft; and unmanned aircraft system cost effectiveness. Warsaw Pact forces will be led and employed according to Soviet operational doctrine which calls for offensive operations with highly mobile, deeply echeloned, and numerically superior land forces, supported by air and sea power. This massive enemy threat indicates a requirement that the maximum number of forces be detected, identified, and destroyed prior to engaging friendly forces. Destruction of enemy forces can be accomplished with artillery, attack helicopters, and close air support, if those targets can be identified and located with sufficient accuracy for timely targeting. GRA

N80-29373# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
OPEN LOOP GUST ALLEVIATION Final Report, Aug. 1978
Manfred Buchstaller, Hugo Kozakiewicz, Rolf Menzl, Wolfgang Reuter, Johannes Schroeder, Siegfried Stauber, and Horst Wuennenberg Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-10) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.90

Previous results, the effectiveness of two alternative gust alleviation concepts, and the technical preacticability of an intended test program were examined. The two concepts are a control system using an elevator alone and a combined system of open and closed loop control. The results examined show that a gust alleviation of 30% is possible with the elevator alone while superposition of the open and closed loop principles improves the pure open loop system, especially at higher frequencies. The practicability study shows that there are neither major technical nor certification problems concerning the realization of a flight test program with the DO 28 TNT as a test aircraft. The symmetrical activation of the ailerons as lift flaps can be realized without feedback to the pilot's control column by a central electrically driven actuator within the fuselage. Elevator control is realized by the trimming spindle. In this case there is a certain feedback to the control column. Signal processing is done digitally. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-29374# Aeronautical Research Labs., Melbourne (Australia).
A PROPOSAL FOR AERODYNAMICALLY ACTUATED SELF STREAMLINING SUBSONIC WIND TUNNEL WALLS
N. Pollock Jun. 1979 27 p refs
(ARL-Aero-Note-392; AR-001-739) Avail: NTIS HC A03/MF A01

An arrangement is described which ensures that solid flexible two dimensional subsonic wind tunnel walls will automatically and continuously assume a shape approximating an unconstrained streamline under the action of a model pressure field. Such a tunnel wall would minimize interference. Each wall consists of a streamwise tensioned membrane with a series of pressure tappings. These pressure tappings communicate with a number of flexible bellows which apply appropriate local forces to the membrane. Methods covering the extension of this concept to a three dimensional configuration are also discussed. Author

N80-29375# Naval Civil Engineering Lab., Port Hueneme, Calif.
FIBERGLASS-REINFORCED PLASTIC SURFACING FOR RAPID RUNWAY REPAIR BY NAVAL CONSTRUCTION Interim Report, Nov. 1978 - Apr. 1979
P. S. Springston Oct. 1979 50 p
(YF53536091)
(AD-A085357; CEL-TN-1563) Avail: NTIS HC A04/MF A01 CSCL 13/3

This report documents exploratory research conducted to develop a preliminary concept for repairing bomb damaged runways with prefabricated fiberglass-reinforced plastic membranes. The membranes would function as trafficable caps over backfilled craters. A structural analysis has been completed using the finite element method and a design is presented for a membrane to be traffic-tested under simulated F-4 aircraft wheel loads at the Rapid Runway Repair Test Facility of the Air Force Engineering and Services Center/Research Division at Tyndall AFB, Florida. Methods for joining panels to form large membranes and a tiedown method are discussed. A general concept for rapid runway repair by the Naval Construction Forces using table-of-allowance (P25 and P31) equipment is presented. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-29376*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEMS DEFINITION STUDY FOR SHUTTLE DEMONSTRATION FLIGHTS OF LARGE SPACE STRUCTURES. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jul. 1979 29 p 3 Vol.

(Contract NAS8-32390)
(NASA-CR-161534; DRD-MA-04-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The development of large space structure technology is discussed, with emphasis on space fabricated structures which are automatically manufactured in space from sheet-strip materials and assembled on-orbit. Definition of a flight demonstration involving an Automated Beam Builder and the building and assembling of large structures is presented. L.F.M.

N80-29377*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEMS DEFINITION STUDY FOR SHUTTLE DEMONSTRATION FLIGHTS OF LARGE SPACE STRUCTURES. VOLUME 2: TECHNICAL REPORT **Final Report**
Jul. 1979 220 p 3 Vol.
(Contract NAS8-32390)
(NASA-CR-161535; DRD-MA-04-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 22A

The development of large space structure (LSS) technology is discussed, with emphasis on space fabricated structures which are automatically manufactured in space from sheet-strip materials and assembled on-orbit. It is concluded that an LSS flight demonstration using an Automated Beam Builder and the orbiter as a construction base, could be performed in the 1983-1984 time period. The estimated cost is $24 million exclusive of shuttle launch costs. During the mission, a simple space platform could be constructed in-orbit to accommodate user requirements associated with earth viewing and materials exposure experiments needs. L.F.M.

N80-29378*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEMS DEFINITION STUDY FOR SHUTTLE DEMONSTRATION FLIGHTS OF LARGE SPACE STRUCTURES. VOLUME 3: THERMAL ANALYSES **Final Report**
Jul. 1979 80 p 3 Vol.
(Contract NAS8-32390)
(NASA-CR-161536; DRD-MA-04-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 22A

The development of large space structure technology is discussed. A detailed thermal analysis of a model space fabricated 1 meter beam is presented. Alternative thermal coatings are evaluated, and deflections, stresses, and stiffness variations resulting from flight orientations and solar conditions are predicted. L.F.M.

N80-29379# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
INTERSTELLAR FLIGHT: WHEN? [INTERSTELLARER FLUG: WANN?]
H. O. Ruppe Jun. 1979 29 p In GERMAN
(TUM-RT-KB-79/3) Avail: NTIS HC A03/MF A01

The possibility of interstellar flight is discussed in connection with project Daedalus. Fabrication of fuel pellets for the drive system is proposed, using Helium 3 obtained from the atmosphere of Jupiter. Author (ESA)

N80-29380# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
SPACEFLIGHT AS AN INFLUENCE ON HUMANITY [RAUMFAHRT FUER DIE MENSCHHEIT]
H. O. Ruppe Jun. 1979 26 p In GERMAN
(TUM-RT-KB-79/4) Avail: NTIS HC A03/MF A01

The application of spaceflight to the solution of some problems of society is discussed. The time scale extends to the end of the present century. Emphasis is placed on the use of satellites of the LANDSAT type for resource exploration, and military security. Commercial applications of space technology are mentioned. Author (ESA)

N80-29381# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
SPACEFLIGHT IN THE YEAR 2000 [RAUMFAHRT IM JAHRE 2000]
H. O. Ruppe Jun. 1979 45 p In GERMAN
(TUM-RT-KB-79/5) Avail: NTIS HC A03/MF A01

The economic and technical aspects of space flight in the near future are discussed. Industrial activity in space in areas such as pharmaceuticals and semiconductors is mentioned, as is the possibility of disposing of nuclear waste in space. Author (ESA)

N80-29382# Hamburg Univ. (West Germany). Lehrstuhl fuer Ingenieurwissenschaften.
PREPARATION OF ALLOYS WITH SPECIFIC PHYSICAL PROPERTIES UNDER ZERO GRAVITY CONDITIONS **Final Report**
Hans Ahlborn and Henning Richter Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 48 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-15) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.65

Based on a study of the literature, possibilities offered by Spacelab for preparation of new or the improvement of conventional materials with specific physical properties were studied. For hard magnetic materials, the lack of thermal convection in space would allow for the preparation of longer and more perfect elongated single domain particles (ESD crystals), the improvement of transcrystallization processes in the fabrication of AlNiCo magnets, and for an undisturbed unidirectional eutectic solidification favoring the production of Mn-Bi as well as superconducting alloys. Crucible free melting of AlNiCo alloys and of Sm-Co alloys could improve their magnetic properties, too. The mixture stability expected in space experiments will allow for the preparation of composite materials with homogeneous distributed second phases for use as electric contact materials and for superconducting materials based on the proximity effect. The expected homogeneous distribution components formed in montectic alloys in the liquid state would also make possible, in the case of Al-Pb alloys, the testing of their properties as bearing materials. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-29383*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENTRY GUIDANCE AND ENTRY AUTOPILOT (STS-1 BASELINE)
J. C. Harpold and Oliver Hill Aug. 1980 126 p refs Supersedes JSC-11746
(NASA-TM-81034; JSC-16515; JSC-11746) Avail: NTIS HC A07/MF A01 CSCL 22A

Preliminary entry guidance and autopilot software formulations, for use in the Mission Control Center (MCC) entry processor, are presented. The MCC requirements are met by a definition of coordinate systems, a list of parameter definitions for the software formulations, a description of the entry guidance detailed formulation requirements, a description of the detailed autopilot formulation requirements, a description of the targeting routine, and a set of formulation flow charts. L.F.M.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also 09 Research Support Facilities (Air).

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-29384 Indian Academy of Sciences, Bangalore.
THE ARYABHATA PROJECT
U. R. Rao, ed. and K. Kasturirangan, ed. 1979 229 p refs Repr. from Proc. of the Indian Acad. of Sci., Sect. C: Eng. Sci (Madras), v. 1, 1978 p 117-343
Copyright. Avail: Issuing Activity

The design and performance of the Aryabhata satellite and its ground support systems is described. The satellite communications, power supply, stabilization, and thermal control systems are individually examined. Tracking and orbit computations and the results of on-board experiments are also discussed. For individual titles, see N80-29385 through N80-29402.

N80-29385 ISRO Satellite Centre, Peenya, Bangalore (India).
AN OVERVIEW OF THE ARYABHATA PROJECT
U. R. Rao *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 1-17 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

An overview of the basic features of the Aryabhata satellite, associated ground stations, and a brief account of the fabrication, testing and (in-orbit) performance of the satellite is given. Results of some of the technological experiments carried out in Aryabhata are also briefly described. Aryabhata was successfully launched into a near-earth orbit on 19 April 1975, from a USSR Cosmodrome. The primary objective of Aryabhata was to establish the indigenous capability in satellite technology. Aryabhata, weighing 358 kg, was quasispherical in shape, and had body-mounted solar cells and Ni-Cd chemical batteries as primary power sources. Other features of the spacecraft include power control systems, passive thermal control system, PCM/FM/PM telemetry system transmitting data at 256 bits/s in real time and 2560 bits/s in the stored mode, PDM/AM/AM telecommand system, cold gas spin stabilisation system with nutation damper, and a number of sensors. The satellite also included three scientific experiments-one on X-ray astronomy, the second for observing solar neutrons and gamma rays and the third on aeronomy.
M.G.

N80-29386 ISRO Satellite Centre, Peenya, Bangalore (India).
THE STABILISATION SYSTEM
P. S. Goel, P. N. Srinivasan, and N. K. Malik *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 19-27 ref (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The design, philosophy, specifications, and the dynamics of the Aryabhata stabilization system are presented along with the qualification and performance evaluation tests of the components and subsystems. Also, the in-orbit performance of the stabilization system is discussed. The attitude stabilization of Aryabhata was accomplished by spinning it about its axis of maximum moment of inertia. The spin stabilization ensures satisfactory thermal control, uniform power generation through the body mounted solar panels, and the scan capability for the scientific payloads. To bring down the nutation of the spinning spacecraft to a value well within the specified limits, a fluid-in-tube damper was also provided.
M.G.

N80-29387 ISRO Satellite Centre, Peenya, Bangalore (India).
THE POWER SYSTEM
S. Y. Ramakrishnan, R. S. Mathur, M. Subramanian, T. Kanthimathinathan, Sudarshan Jarpangal, S. T. Venkataramanan, and N. I. Savalgi *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 29-40 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The power system for Aryabhata satellite is described in detail. The Aryabhata power system consists of solar panels using n/p radiation protected silicon cells, a Ni-Cd storage battery, a solar array voltage limiter, a power control unit which functions as a battery controller, power conditioning regulators, converters, and protective devices which serve mainly as load interface units. The in-orbit performance of the power system is dealt with, highlighting the probable reasons for the failure of one of the bus-lines of the power system.
M.G.

N80-29388 ISRO Satellite Centre, Peenya, Bangalore (India).
THE THERMAL CONTROL SYSTEM
H. N. Murthy, V. K. Kaila, V. Prasad, D. R. Bhandari, H. Bhojaraj, and P. P. Gupta *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 41-56 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The design, analysis, and performance of the thermal control system of Aryabhata is discussed. A passive thermal control system, using flat absorber-AK-512 black paint for the outer surface of the satellite and a combination of solar reflector-AK-512 white pain and mechanical polishing for the inner surfaces, was employed to maintain the temperature of all the electronics subsystems onboard the satellite within the specified limits of 0 C and 40 C during the operational life of the satellite. The in-flight temperature data obtained from sixteen temperature sensors onboard the satellite was compared with the theoretically predicted temperature values and the agreement was good for all electronic subsystems housed within the framework of the satellite. The observed deviations in temperature for the tape recorder, proportional counter package, and gas bottles of the spin-up system are attributed to the assumptions made for the mathematical model. It has been found that by improving these approximations, the deviations could be reduced to negligible values.
M.G.

N80-29389 ISRO Satellite Centre, Peenya, Bangalore (India).
ATTITUDE AND TEMPERATURE SENSORS
G. A. Kasiviswanathan (INSAT Proj. Office, Bangalore, India), V. P. V. Varadarajulu, P. R. Venkateswaran, and T. K. Alex *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 57-68 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The sensors used in the Aryabhata satellite for attitude determination and thermal control are described in some detail. Solar aspect sensors and a triaxial magnatometer were used for attitude reconstruction of the spin axis. A spin angle clock was used for sectoring the scan field of the equatorially-mounted X-ray experiment package. A set of thermistors placed at various locations of the satellite provided information on the thermal behavior of the satellite.
M.G.

N80-29390 ISRO Satellite Centre, Peenya, Bangalore (India).
THE TELEMETRY SYSTEM
D. V. Raju, R. K. Rajangam, P. S. Rajyalakshmi, C. N. Venkateshaiah, R. Seshaiah, V. Nalanda, S. R. Nagaraj, and R. Sivaswamy *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 69-78 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The telemetry system employed in Aryabhata is described. The telemetry link provides a means for monitoring diagnostic and other parameters for efficient and controlled operation of the satellite besides transmitting data pertaining to the three scientific experiments. A time multiplexed pulsed code modulation (PCM) system was used along with a parallel redundant system which could be switched on by using gorund commands. The system utilized a 128 word, 8 bits per word format. The PCM signal frequency modulates a 22 kHz + or - 7.5% subcarrier which was given to the transmitter for phase modulation of the main carrier. The qualification tests and in-orbit performance of the telemetry system are also described.
M.G.

N80-29391 ISRO Satellite Centre, Peenya, Bangalore (India).
THE COMMUNICATION SYSTEM
M. K. Saha (INSAT Proj. Office, Bangalore, India), V. Gopal Rao, N. Manthian, S. Kalyanaraman, and M. L. Sastry *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 79-88 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The salient features of system design considerations for both uplink and downlink, subsystem details, and the in-orbit performance of the communication system for Aryabhata are discussed. The communication system comprises the telemetry link at 137.44 MHz and the telecommand link at 148.25 MHz. The onboard system consists of two telemetry transmitters and two

telecommand receivers both coupled to a common antenna via a hybrid coupler unit, which isolates the command receiver from the telemetry transmitter. A stable telemetry carrier frequency of 137.44 MHz is also used for tracking. Telemetry data in pulse coded modulation are frequency-modulated on a subcarrier frequency of 22 kHz and the composite signal phase modulates the carrier to provide interference-free reception in narrow band carrier tracking systems. For reliability of the onboard system the principle of parallel redundancy is used. The telecommand is an amplitude modulated system. The received signals at the satellite antenna after detection by receivers are fed to a command decoder for the execution of command operations. M.G.

N80-29392 ISRO Satellite Centre, Peenya, Bangalore (India).
THE TELECOMMAND SYSTEM
R. Ashiya, J. P. Gupta, Y. K. Singla, D. Venkataramana, A. Bhatkaranarayana, U. N. Das, and R. V. Seshadri *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 89-104 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The system design, specifications, and performance of both the ground and onboard segments of the telecommand system system developed for the spacecraft Aryabhata are described. Particular attentionis given to the command decoder and the command control units. The operations performed by the telecommand system include energising various subsystems, tape recorder operations, spin-up of satellite, phased operation of experiments, and switching over to redundant system during emergency/failure of main units. M.G.

N80-29393 ISRO Satellite Centre, Peenya, Bangalore (India).
ANTENNA SYSTEMS FOR THE ARYABHATA MISSION
S. P. Kosta, S. Pal, P. K. Reddy, V. K. Lakshmeesha, K. N. S. Rao, K. N. Shamanna, V. Mahadevan, V. S. Rao, and L. Nicholas *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 105-118 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The onboard ground antenna system employed in the Aryabhata mission for telemetry and telecommand operations are described. The onboard antenna system common to telemetry and telecommand frequencies consists of four monopoles fed in turnstile configuration and generates a near isotropic pattern with worst dips of the order of -10 dB over approximately 0.2% of the total radiation sphere area. The ground antenna system consists of a high gain (18 dB) telecommand antenna and a telemetry array of eight medium gain Yagis (gain 22 dB).Author

N80-29394 ISRO Satellite Centre, Peenya, Bangalore (India).
THE TRACKING SYSTEM
M. K. Saha, S. Kalyanaraman, S. N. Prasao, R. N. Tyagi, T. K. Jayaraman, M. Sambasiva Rao, and S. G. Basu *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 119-133 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The satellite tracking system was used for Aryabhata. The total system consists of (1) an interferometry system to measure the direction cosine angles of the satellite with respect to the ground station, (2) a tone-ranging system to measure the range of the satellite and (3) a Doppler system to measure the range rate of the satellite. The system accuracies obtained were plus or minus 10 feet of an arc in the direction cosine angles, plus or minus 1.0 km in the range and plus or minus 6.6 m/s in the range rate. R.C.T.

N80-29395 ISRO Satellite Centre, Peenya, Bangalore (India).
THE STRUCTURE
A. V. Patki *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 135-150 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The design, analysis and testing methods of the Aryabhata satellite structure are briefly presented. The general requirements and constraints which formed the basis of the design of the structure are explained. The theoretical and experimental studies conducted to evaluate the structural behaviour under various environmental loads expected during ground operations and during flight are also described. The salient features of the fabrication procedures and the details of physical parameters are presented. The structure is evaluated on the basis of the results of ground tests and the flight performance. R.C.T.

N80-29396 ISRO Satellite Centre, Peenya, Bangalore (India).
SYSTEM INTEGRATION
V. A. Thomas, M. N. Sathyanarayan, V. R. Katti, A. A. Bokil, N. R. Dathathri, G. Mohanakrishnan, K. Pattabhiraman, K. Goswami, T. L. Danabalan, and I. Selvaraj *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 151-162 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The various aspects of satellite integration are discussed. A detailed plan is given for both mechanical and electrical integration of Aryabhata, elucidating the integration procedures and practices which were evolved to cater to the various types of interface requirements between the different onboard subsystems as well as between the spacecraft and the rocket carrier. R.C.T.

N80-29397 ISRO Satellite Centre, Peenya, Bangalore (India).
THE GROUND CHECKOUT SYSTEM
Tarsem Singh, A. D. Dharma, O. P. Sapra, V. R. Pratap, K. A. Narayanan, S. Subbiah, J. V. Ingle, A. S. Bhamavati, and B. K. Shamaprakash *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 163-173 (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The ground checkout system used for testing the Aryabhata from integration stage to launch from Cosmodrome in USSR is described. Introduction and design details are followed by brief descriptions of the system elements and test philosophy. R.C.T.

N80-29398 ISRO Satellite Centre, Peenya, Bangalore (India).
ORBIT COMPUTATIONS
R. S. Bhat and C. K. Rajasingh *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 175-186 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

Orbital information for Aryabhata was computed and made available for telemetry and tracking schedules and for mission analysis. Taking an available state-vector once in a week from USSR, the orbital computations were made for the first four months using a numerical integration procedure. During the later period of the mission, an analytical method was adopted to reduce the computer time. Arysbhata, in a near circular orbit at 600 km and having an inclination of 50.68 deg, experienced a constant atmospheric drag due to which the semimajor axis decayed by about 0.5 km in one year. The nodal regression rate, due to asphericity of the earth, was almost constant at 4.632 deg/day. The inclination remained constant throughout the year. Author

N80-29399 ISRO Satellite Centre, Peenya, Bangalore (India).
A STATISTICAL ANALYSIS OF WEIGHT AND COST PARAMETERS OF SPACECRAFT WITH SPECIAL REFERENCE TO ARYABHATA
P. N. Pathak *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 187-196 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The available data on the weights of several NASA and ESRO spacecraft were statistically analysed using the regression analysis technique and empirical relationships of the type W sub T = AW sub x (beta) have been established, where W sub T is the total weight of the spacecraft, W sub x is the weight of one of its chosen subsystems and A and beta are constants for the chosen subsystem. It is found that the weight data of Aryabhata show a fairly good fit with these empirical relationships. Further, using an established statistically derived relationship for NASA satellites, involving the cost of a spacecraft and its weight parameters, it is found that the cost of Aryabhata is much lower than that of other NASA satellites of comparable weight. The implications of these results are briefly discussed. R.C.T.

N80-29400 Tata Inst. of Fundamental Research, Bombay (India).
AN EXPERIMENT TO DETECT ENERGETIC NEUTRONS AND GAMMA RAYS FROM THE SUN
M. V. K. AppaRao, S. V. Damle, R. R. Daniel, G. S. Gokhale, George Joseph, R. U. Kundapurkar, and P. J. Lavakare *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 197-203 refs

(For primary document see N80-29384 20-15)
Avail: Issuing Activity

A payload for the detection and measurement of high energy neutrons and gamma rays from the sun was flown onboard the first Indian satellite Aryabhata. The payload system for this neutron-gamma experiment was designed for detecting energetic neutrons in the energy range 10-500 MeV and gamma rays in the energy range 0.2-20 MeV. The details of the design of the payload, various tests carried out on it as well as the preliminary in orbit performance are presented. Author

N80-29401 Physical Research Lab., Ahmedabad (India).
THE AERONOMY EXPERIMENT
S. Prakash, B. H. Subbaraya, V. Kumar, P. N. Pareek, J. S. Shirke, R. N. Misra, K. Goswami (ISRO Satellite Centre), R. S. Singh, and A. Ranerjee (National Physical Lab., New Delhi, India) *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 205-213 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

The experiments described here were flown on Aryabhata and were mainly designed to study the global distribution of suprathermal electrons, ionosphere-magnetosphere coupling, the F region anomaly and the hydrogen geocorona. The experiments consisted of a retarding potential analyser and two ultraviolet ion chambers. The former was designed for the measurement of the flux of suprathermal electrons in the Earth's atmosphere while the latter was for measuring the intensity of the resonantly scattered hydrogen Lyman alpha (1216 angstroms) and photoelectronically excited OI (1304 angstroms) emissions. Author

N80-29402 ISRO Satellite Centre, Peenya, Bangalore (India).
THE X-RAY ASTRONOMY EXPERIMENT
U. R. Rao (Physical Research Lab.), K. Kasturirangan, Y. K. Jain, Arun Batra, V. Jayaraman, R. A. Ganage, D. P. Sharma, and M. S. Radha *In* Indian Acad. of Sci. The Aryabhata Proj. 1979 p 215-227 refs (For primary document see N80-29384 20-15)
Avail: Issuing Activity

One of the scientific experiments onboard Aryabhata was designed to detect and measure celestial X-rays in the energy range 2.5 - 1550.0 keV. The payload systems comprising proportional counter and scintillation counter telescopes were intended for observations in the pointed and scan modes respectively for investigating the emission properties of celestial X-ray sources. The details of these telescopes, their inflight performance as well as the nature of the data obtained during the first few orbits are presented. R.C.T.

N80-29403 Academy of Sciences (USSR), Moscow. Inst. for Space Research.
A GEOSYNCHRONOUS PROBE FOR EXTRAECLIPTIC STUDIES OF THE SOLAR WIND AND FOR ASTROPHYSICAL INVESTIGATIONS
V. M. Balebanov, A. E. Balikhin, O. L. Vaisberg, V. B. Zhuravlev, A. N. Matveev, G. A. Mersov, and V. S. Troshin 1979 17 p refs
(D-279) Copyright. Avail: NTIS HC A02

The concept of a probe being launched into a heliocentric orbit is examined. To accommodate solar wind experiments the orbital plane must be inclined to the ecliptic plane. The orbital parameters of the probe are chosen basically the same as those of the Earth, while the launching procedure provides a synchronous orbital motion of the probe with the Earth. It is shown that this orbit provides a unique opportunity to fix the direction of the probe Earth baseline in inertial space. The probe is to be spin stabilized; a possible hardware configuration is discussed. The spin axis of the probe and the lines of sight of the astrophysical equipment are to be colinear with the probe Earth baseline, thus allowing for the combination astrophysical and out-of-ecliptic experiments. It is also shown that the proposed spin stabilization of the probe can be achieved using only optical solar sensors and very simple logic. The axis of the radio communication antenna, being parallel to the spin axis, provides continuous communication with the Earth. Author (ESA)

N80-29404# RAND Corp., Santa Monica, Calif.
A PRELIMINARY ANALYSIS OF THE EFFECT OF WORK-AROUNDS ON SPACE SYSTEM PERFORMANCE AND PROCUREMENT REQUIREMENT: A PROPOSAL Interim Report
Gary Parish and William Sollfrey Mar. 1980 33 p
(Contract F49620-77-C-0023)
(AD-A085644; RAND/N-1260-AF) Avail: NTIS HC A03/MF A01 CSCL 22/2

This note identifies a factor that appears to have been neglected in explaining the discrepancy between predicted and observed satellite lifetimes in orbit. This factor--extension of satellite life through ingenious 'work-around' corrections--is not represented in current satellite replenishment models. The note explores the effect of this omission on various measures of system performance, develops an analytical method of incorporating these work-arounds in replenishment models, and derives an initial estimate of the required parameters from a convenient data base. Incorporating the effect of work-arounds dramatically improves system performance and lowers procurement requirements. GRA

N80-29405# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PERFORMANCE OF MULTIPLE SATELLITE SYSTEMS WITH COMMON DOWNLINK FREQUENCY HOPPING PATTERNS
Jeannine Mosely 29 Feb. 1980 32 p refs
(Contract F19628-80-C-0002; AF Proj. 2487; AF Proj. 2028) (AD-A085590; TN-1980-14; ESD-TR-80-18) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report considers a situation in which more than one satellite transmitting frequency-hopped signal is in view of a given terminal. If it is desired that the satellites use the same frequency hopping pattern for ease of acquisition and handover, then a receiver which is in range of more than one satellite may encounter interference. This interference is analyzed for a generalized system of two satellites modelled after the LES-8/9 system. Upperbounds for the probability of error are derived for receivers using a square-law combining rule. This expression is evaluated for the LES-8/9 system, using two different downlink codes. It is seen that the choice of code makes a significant difference in system performance, and that with a suitably chosen code, two satellites may use the same frequency hopping pattern without significant performance degradation. GRA

N80-29406# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
AN ELEVATOR IN SPACE [MIT DEM FAHRSTUHL INS ALL]
H. O. Ruppe Jun. 1979 25 p In GERMAN
(TUM-RT-KB-79/6) Avail: NTIS HC A02/MF A01

A geostationary shaft satellite is proposed which is vertically stabilized in the Earth's gravitational field. The shaft is prolonged above and below the satellite so that it stays in stable equilibrium; the prolongation is continued until the inferior branch reaches the Earth's surface. The base is fixed and masses are attached to the superior branch so that the 'ladder' is stretched with the help of centrifugal force. In principle an elevator could then be installed in this tower. Author (ESA)

N80-29407# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabteilung Raumfahrtprogramme.
CONCEPTUAL STUDY OF A EUROPEAN REMOTE SENSING SATELLITE WITH COMBINED OPTICAL AND MICROWAVE PAYLOAD Final Report
Wolfgang Gilg, E. Achtermann, K.-L. Bitzer, K. Ernsberger, K.-H. Fabiunke, G. Lehn, W. Schuler, W. Trogus, E. Velten, M. Westphal et al Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 110 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Germany (BMFT-FB-W-79-18) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22,70

The concept of a European remote sensing satellite (ERDSAT) launched by ARIANE and carrying a model payload, consisting of a synthetic aperture radar and an optical multispectral scanner with nine channels for land applications or coastal zone missions is characterized. The mission goal of ERDSAT is based on European user requirements where a strong need for optical and microwave sensor operation on board the same satellite in a simultaneous or sequential mode is expressed. A data collection system is

included. The proposed satellite is three-axes-stabilized and has a Sun-synchronous, near polar circular orbit at 750 km altitude. The selected configuration separates payload module and bus module. A thermostable carbon fiber grating structure constitutes the central framework of the satellite. Each major subsystem is housed in a separate compartment and can be integrated and tested individually. First mass estimates result in 450 kg for the payload and 880 kg for the bus. The maximum power needed is 1750 W (for 6 minutes, three times a day), which is provided by a 1330 W solar array and two batteries. Author (ESA)

N80-29408# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON NOSE CONE DEVELOPMENT Final Report
Rainer Henkel, Gerhard Maier, Helmut Meier, and Walter Schrieder Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 64 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-W-79-20; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13

In response to a demand for a universal nose cone design for sounding rocket applications various split type nose cones with different separation mechanisms, presently available on the market, were studied. The study includes a comparison of different construction principles regarding minimal disturbance and spin reduction on takeoff. Results show that a nose cone for universal application is not a reasonable concept, since the requirements vary too greatly depending on the mission. Author (ESA)

N80-29409# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
INTRODUCTION TO THE VARIOUS LAWS OF MISSILE GUIDANCE
K. Becker Aug. 1979 89 p refs In GERMAN; ENGLISH summary
(FFM-285) Avail: NTIS HC A05/MF A01

The success of a missile attacking a target is essentially dependent on the guidance principle adopted. Some typical missile control schemes are discussed and their advantages and disadvantages are shown. Strategies considered are the pre-computed course, line of sight guidance, pursuit guidance, constant bearing guidance, proportional navigation, and some modern strategies based on optimal control. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also 03 Air Transportation and Safety and 85 Urban Technology and Transportation.

N80-29410*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
STS-1 ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM. CONSUMABLES AND THERMAL ANALYSIS
G. Steines (McDonnell Douglas Technical Services Co.) Aug. 1980 32 p refs
(NASA-TM-81035; JSC-16720; Rept-80-FM-33) Avail: NTIS HC A03/MF A01 CSCL 22B

The Environmental Control and Life Support Systems (ECLSS)/thermal systems analysis for the Space Transportation System 1 Flight (STS-1) was performed using the shuttle environmental consumables usage requirements evaluation (SECURE) computer program. This program employs a nodal technique utilizing the Fortran Environmental Analysis Routines (FEAR). The output parameters evaluated were consumable quantities, fluid temperatures, heat transfer and rejection, and cabin atmospheric pressure. Analysis of these indicated that adequate margins exist for the nonpropulsive consumables and related thermal environment. Author

N80-29411*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER ELECTRICAL EQUIPMENT UTILIZATION BASELINE
Aug. 1980 790 p
(JSC-12561; Rept-77-FM-2-Rev-5; NASA-TM-81125) Avail: NTIS HC A99/MF A01 CSCL 22B

The baseline for utilization of Orbiter electrical equipment in both electrical and Environmental Control and Life Support System (ECLSS) thermal analyses is established. It is a composite catalog of Space Shuttle equipment, as defined in the Shuttle Operational Data Book. The major functions and expected usage of each component type are described. Functional descriptions are designed to provide a fundamental understanding of the Orbiter electrical equipment, to insure correlation of equipment usage within nominal analyses, and to aid analysts in the formulation of off-nominal, contingency analyses. L.F.M.

N80-29412*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE). VOLUME 1: USER'S GUIDE
Edwin Dupnick and Diana Wiggins (Lockheed Electronics Co., Inc., Houston, Tex.) Feb. 1980 41 p 3 Vol.
(NASA-TM-8114; JSC-16395-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

An interactive computer program for automatically generating traffic models for the Space Transportation System (STS) is presented. Information concerning run stream construction, input data, and output data is provided. The flow of the interactive data stream is described. Error messages are specified, along with suggestions for remedial action. In addition, formats and parameter definitions for the payload data set (payload model), feasible combination file, and traffic model are documented. R.C.T.

N80-29413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE). VOLUME 2: MISSION PAYLOADS SUBSYSTEM DESCRIPTION
Edwin Dupnick and Diana Wiggins (Lockheed Electronics Co., Inc., Houston, Tex.) Feb. 1980 182 p
(NASA-TM-81115; JSC-16395-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 22A

The scheduling algorithm for mission planning and logistics evaluation (SAMPLE) is presented. Two major subsystems are included: The mission payloads program; and the set covering program. Formats and parameter definitions for the payload data set (payload model), feasible combination file, and traffic model are documented. R.C.T.

N80-29414*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ET LOX MODAL SURVEY ANALYSIS AND TEST ASSESSMENT
R. L. McComas May 1980 32 p
(NASA-TM-78287) Avail: NTIS HC A03/MF A01 CSCL 22B

The results are presented of the analysis and modal test of the liquid oxygen tank and intertank of the space shuttle external tank. The analytical models, test article, and support hardware are described. Frequency and damping are compared on a mode-by-mode basis. The data assessment clearly confirms the validity of the analytical model and establishes a high level of confidence that the methodology will accurately predict modal characteristics of flight configurations. Author

N80-29415*# Rocket Research Corp., Redmond, Wash.
INCREASED CAPABILITY GAS GENERATOR FOR SPACE SHUTTLE APU. DEVELOPMENT/HOT RESTART TEST REPORT
7 Jul. 1980 95 p
(Contract NAS9-16002)
(NASA-CR-160764; Rept-80-R-695) Avail: NTIS HC A05/MF A01 CSCL 22B

The design, fabrication, and testing of an increased capability gas generator for use in space shuttles are described. Results show an unlimited hot restart capability in the range of feed pressures from 400 psi to 80 psi. Effects of vacuum on hot restart were not addressed, and only beginning-of-life bed

conditions were tested. No starts with bubbles were performed. A minimum expected life of 35 hours or more is projected, and the design will maintain a surface temperature of 350 F or more. L.F.M.

N80-29416*# ARO, Inc., Arnold Air Force Station, Tenn.
SPACE SHUTTLE ORBITER SILTS POD FLOW ANGULARITY AND AERODYNAMIC HEATING TESTS (OH-102A AND OH-600) Final Report, Oct. 1978 - Oct. 1979
K. W. Nutt AEDC Nov. 1979 52 p refs Sponsored by NASA, Johnson Space Flight Center
(NASA-CR-163326; AD-A086195; AEDC-TSR-79-V70) Avail: NTIS HC A04/MF A01 CSCL 20/4

Heat transfer, flow field, and oil flow tests were conducted on a 0.0175 scale model of the space shuttle orbiter. The tests were conducted at Mach 8. The objective of the tests was to determine the aerodynamic heating distribution on the orbiter SILTS tail configuration and to obtain flow field total pressure and total temperature measurements at the location of the leading edge of the vertical tail. The tests were conducted at free-stream Reynolds numbers ranging from 0.5 to 3.7 million per ft. The model angle of attack was varied from -5 to 5 deg and from 30 to 40 degrees. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-29417*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF SPACE SHUTTLE ORBITER ENTRY DYNAMICS FROM MACH 10 TO MACH 2.5 WITH THE NOVEMBER 1976 FLIGHT CONTROL SYSTEM
Richard W. Powell and Howard W. Stone Aug. 1980 163 p
(NASA-TP-1667; L-13344) Avail: NTIS HC A08/MF A01 CSCL 22B

A six-degree-of-freedom simulation analysis was performed for the space shuttle orbiter entry from Mach 10 to Mach 2.5 with realistic off-nominal conditions using the flight control system referred to as the November 1976 Integrated Digital Autopilot. The off-nominal conditions included: (1) aerodynamic uncertainties in extrapolating from wind tunnel of flight characteristics, (2) error in deriving angle of attack from onboard instrumentation, (3) failure of two of the four reaction control-system thrusters on each side (design specification), and (4) lateral center-of-gravity offset. Many combinations of these off-nominal conditions resulted in a loss of the orbiter. Control-system modifications were identified to prevent this possibility. Author

N80-29418*# Old Dominion Univ., Norfolk, Va. Dept. of Mathematical Sciences.
PRELIMINARY INVESTIGATIONS INTO THE ACTIVE CONTROL OF LARGE SPACE STRUCTURES: SOLUTION OF THE TIMOSHENKO BEAM EQUATIONS BY THE METHOD OF CHARACTERISTICS Final Report, 15 Feb. 1978 - 15 Aug. 1980
John Tweed Aug. 1980 197 p refs
(Grant NsG-1279)
(NASA-CR-163408) Avail: NTIS HC A09/MF A01 CSCL 22B

An algorithm was developed and incorporated into a computer program for solving the damped, Timoshenko beam equations with free-free boundary conditions and prescribed initial data. A number of special cases are considered and, where appropriate, comparisons are made with known results. A.R.H.

N80-29419*# California Univ., San Diego, La Jolla. Center for Astrophysics and Space Sciences.
ANALYSIS OF DIFFERENTIAL AND ACTIVE CHARGING PHENOMENA ON ATS-5 AND ATS-6 Final Report, May 1977 - Dec. 1979
R. C. Olsen and E. C. Whipple, Jr. 30 Jul. 1980 154 p refs
(Grant NsG-3150)
(NASA-CR-163433; UCSD-CASS-80-1) Avail: NTIS HC A08/MF A01 CSCL 22B

Spacecraft charging on the differential charging and artificial particle emission experiments on ATS 5 and ATS 6 were studied. Differential charging of spacecraft surfaces generated large electrostatic barriers to spacecraft generated electrons, from photoemission, secondary emission, and thermal emitters. The electron emitter could partially or totally discharge the satellite, but the mainframe recharged negatively in a few 10's of seconds. The time dependence of the charging behavior was explained by the relatively large capacitance for differential charging in comparison to the small spacecraft to space capacitance. A daylight charging event on ATS 6 was shown to have a charging behavior suggesting the dominance of differential charging on the absolute potential of the mainframe. Ion engine operations and plasma emission experiments on ATS 6 were shown to be an effective means of controlling the spacecraft potential in eclipse and sunlight. Elimination of barrier effects around the detectors and improving the quality of the particle data are discussed. R.K.G.

N80-29420# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LIFT-DISPERSION CONTROL OF SPINNING REENTRY VEHICLES Interim Report
D. H. Platus 10 Apr. 1980 41 p refs
(Contract F04701-79-C-0080)
(AD-A085457; TR-0080(5940-02)-1; SD-TR-80-22) Avail: NTIS HC A03/MF A01 CSCL 16/3

A control system is described that will limit cross-range dispersion of spinning reentry vehicles caused by lift variations. The controls consist of small trim flaps or reaction jets that utilize information derived from strapdown motion sensors to minimize lift nonaveraging. Because epicyclic oscillations in angle of attack do not cause dispersion, only the phasing of complex angle-of-attack motion must be controlled to minimize the net transverse velocity that would otherwise result from lift variations. This requires relatively little control energy compared with a system that would trim the vehicle at zero angle of attack. A simple control law is derived that specifies minimum feedbacks required, and the open- and closed-loop vehicle response to impulsive disturbance moments is demonstrated. GRA

N80-29421# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ACOSS FOUR (ACTIVE CONTROL OF SPACE STRUCTURES) THEORY, VOLUME 1 Final Technical Report, 24 Jul. 1978 - 31 Dec. 1979
Robert R. Strunce, Daniel R. Hegg, Jiguan G. Lin, and Timothy C. Henderson Griffiss AFB, N.Y. RADC Apr. 1980 68 p refs 2 Vol.
(Contract F30602-78-C-0268; ARPA Order 3654)
(AD-A085654; R-1338-Vol-1; RADC-TR-80-78-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22/2

The objective of the research reported here was to develop the theoretical and analytical tools to support the successful implementation of active vibration control of large flexible spacecraft. Parallel efforts in theory and applications were initiated. For the theoretical effort, several representative design methods

were selected for careful study focusing on an examination of the theoretical basis for each method and potential difficulties associated with their use in reduced-order large space structure controller design. The methods initially selected are characterized by constant-gain output feedback, the simplest form of active multivariable control; (1) modal decoupling, (2) pole assignment, (3) optimal output feedback, (4) suboptimal output feedback, and (5) stochastic optimal output feedback. A performance comparison of specific designs with these methods was made. Extensions to the published Kosut methods of suboptimal output feedback are developed, as well as the details of an algorithm necessary for a numerical solution. GRA

N80-29422# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ACOSS FOUR (ACTIVE CONTROL OF SPACE STRUCTURES) THEORY. VOLUME 2: APPENDIX Final Technical Report, 24 Jul. 1978 - 31 Dec. 1979
Robert R. Strunce, Daniel R. Hegg, Jiguan G. Lin, and Timothy C. Henderson Griffiss AFB, N.Y. RADC Apr. 1980 64 p 2 Vol.
(Contract F30602-78-C-0268; ARPA Order 3654)
(AD-A085816; R-1338-Vol-2-App.; RADC-TR-80-78-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 22/2

This is the Charles Stark Draper Laboratory, Inc., final technical report on its Actively Controlled Structures Theory Study. The objective of the research reported here was to develop the theoretical and analytical tools to support the successful implementation of active vibration control of large flexible spacecraft. Parallel efforts in theory and applications were initiated. For the theoretical effort, several representative design methods were selected for careful study focusing on an examination of the theoretical basis for each method and potential difficulties associated with their use in reduced-order large space structure controller design. The methods initially selected are characterized by constant-gain output feedback, the simplest form of active multivariable control; (1) Modal Decoupling, (2) Pole Assignment, (3) Optimal Output Feedback, (4) Suboptimal Output Feedback, and (5) Stochastic Optimal Output Feedback. A performance comparison of specific designs with these methods was made. Extensions to the published Kosut methods of suboptimal output feedback are developed, as well as the details of an algorithm necessary for a numerical solution. Techniques and conditions are developed for reduction of control (observation) spillover by placement of actuators (sensors), by synthesis of the actuator (sensor) influences, and by compensation of actuators (sensors). GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-29423# Aerospace Corp., El Segundo, Calif. Engineering Group.
ONE- AND TWO-PHASE NOZZLE FLOWS Final Report, Jan. 1978 - Jan. 1980
I-Shih Chang 31 Jan. 1980 64 p refs
(Contract F04701-79-C-0080)
(AD-A085806; TR-0080(5901)-01-1; SD-TR-80-26) Avail: NTIS HC A04/MF A01 CSCL 21/8

A time-dependent technique, in conjunction with the boundary-fitted coordinates system, is applied to solve a gas only one phase flow and a fully coupled, gas-particle two phase flow inside nozzles with small throat radii of curvature, steep wall gradients, and submerged configurations. The emphasis of the study has been placed on one and two phase flow in the transonic region. Various particle size and particle mass fractions have been investigated in the two phase flow. The salient features associated with the two phase nozzle flow compared with those of the one phase flow are illustrated through the calculations for a JPL nozzle configuration, for the Titan 3 solid rocket motor nozzle, and for the submerged nozzle configuration utilized in the Inertial Upper Stage (IUS) solid rocket motor. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N80-29424 Tennessee Univ., Knoxville.
ANISOTROPIC TENSILE AND NOTCHED BEND PROPERTIES OF AN Al-Al3Ni DIRECTIONALLY SOLIDIFIED FIBER REINFORCED COMPOSITE Ph.D. Thesis
Dennis Wayne Hetzner 1980 191 p
Avail: Univ. Microfilms Order No. 8018481

Eutectic alloy ingots having dimensions of approximately 1/2" x 4" x 4" were directly solidified. The tensile strength of the composite was found to vary in a manner similar to that predicted for mechanically formed fiber reinforced composites. The fracture modes were also similar to those predicted for mechanically formed fiber reinforced composites. The notched bend strength of the composite was found to decrease for fiber orientations up to 45 deg and then remain constant for fiber orientations from 45 deg to 90 deg. In all cases fracture was initiated by the cracking of large Al3Ni blades within cell boundaries. Dissert. Abstr.

N80-29425 Illinois Univ. at Urbana-Champaign.
MICROSTRUCTURE AND MICROCHEMISTRY OF TITANIUM CARBIDE COATED CEMENTED CARBIDES Ph.D. Thesis
Nirmal Kumar Sharma 1980 97 p
Avail: Univ. Microfilms Order No. 8017981

A microchemical and microstructural analysis of TiC coated cemented carbides was performed using a variety of contemporary microanalytical techniques: Auger electron spectroscopy; STEM X-ray microchemical analysis; and electron energy loss spectroscopy. As most of the analytical techniques used are in their infancy for quantitative analysis, it was necessary to develop special procedures for quantitation and interpretation of the data obtained. A quantitative formalism was developed using single crystals and binary carbide mixtures of known composition to obtain quantitative microchemical information of every few atomic layers between TiC coatings and cemented carbide substrates. The procedure when applied to the interface between cemented carbides and TiC coatings obtained by chemical vapor deposition, activated reactive evaporation and dc biased radio frequency sputtering showed loss of carbon in all cases. Each interface revealed a different degree of decarburization and intermixing, and all of them lacked the desired low decarburization and high intermixing. Dissert. Abstr.

N80-29426 Illinois Univ. at Urbana-Champaign.
LOW-TEMPERATURE DENSIFICATION OF LEAD ZIRCONATE TITANATE WITH VANADIUM PENTOXIDE ADDITIONS Ph.D. Thesis
Dale Edward Wittmer 1980 157 p
Avail: Univ. Microfilms Order No. 8018217

The addition of 0.1 to 5.0 w/o V2O5 to lead zirconate titanate (PZT) ceramics promoted rapid densification below 975 C; thereby eliminating the need for PbO atmosphere control. The base PZT, Pb(Zr0.53 Ti0.47)O3, was prepared by coprecipitation from mixed oxides and butoxides. The V2O5 was incorporated as mill additions to the precalcined base PZT, as batch additions to the PZT during the coprecipitation process, and as mill additions to a commercially available PZT powder. Densification rates were enhanced by the additions of V2O5. Densities greater than 98% of theoretical were obtained in approximately 15 minutes of 960 C for additions of 0.1 to 1.0 w/o V2O5 addition and were at least comparable to the base PZT. Indications are that accelerated densification is due to a combined surface activated liquid phase mechanism. It was proposed that the V2O5 becomes incorporated into the surface layers of the oxide powders during mixing or in the coprecipitation process. Dissert. Abstr.

N80-29427 Rice Univ., Houston, Tex.
FATIGUE DAMAGE IN A WC-NICKEL CEMENTED CARBIDE COMPOSITE Ph.D. Thesis
Eric F. Drake 1980 85 p
Avail: Univ. Microfilms Order No. 8018045

A model WC-Ni cemented carbide was designed to investigate the response of this type of composite to compressive cyclic loading. The material's monotonic stress-strain behavior was studied in the compressive range, revealing considerable microstrain plasticity and rapid strain-hardening characteristic of this composite family. Specimens were mechanically conditioned at 20 Hz for one million cycles using a zero-compression zero sinusoidal program in stress control. Peak stress was varied in increments from zero to 1900 MPa, where failure was observed. Bulk hardness, residual stress state, and fracture toughness were monitored as a function of cyclic stress. Only modest shifts in bulk behavior were observed. On a local scale, fatigue effects on dislocation density and structure were found in the binder phase by transmission electron microscopy. As cyclic stress levels were raised, favorably oriented grain-boundary-ledge dislocation sources were activated, leading to precipitate-free bands of intense slip. Dissert. Abstr.

N80-29428 Akron Univ., Ohio.
THE ROLE OF RUBBER-PLASTIC ADHESION IN THE REINFORCEMENT OF ELASTOMER COMPOSITES Ph.D. Thesis
Tsung-I Chen 1980 152 p
Avail: Univ. Microfilms Order No. 8017436

Polymeric fillers, such as polystyrene, poly(methyl methacrylate) and polyacenaphthylene, were prepared by emulsion polymerization. The filler elastomer adhesion as indicated by 'dewetting' on stretching, was measured by volume changes in the case of SBR filled with polymeric fillers, the increase in volume was a linear function of the extension ratio (lambda), within the range studied (lambda = 3 approximately 4). At the same volume fraction, the smaller size fillers showed a lower degree of dewetting than the large size filler. An adsorbed layer of soap on the filler particles reduced the volume changes and improved the adhesion, and thus raised the tensile strength of the filled rubber. Uniaxial stress-strain measurement showed that the hysteresis of the filled vulcanizates was related to the particle size, the nature of surface at the interface and the Young's modulus of the filler. A linear increase in volume with respect to extension ratio was found to occur at low extension ratio (lambda < 4) in elastomeric triblock copolymers. At higher extension ratio, the volume changed more rapidly. Dissert. Abstr.

N80-29429*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THERMAL EXPANSION OF COMPOSITES USING MOIRE INTERFEROMETRY
David E. Bowles (Virginia Polytech. Inst. and State Univ., Blacksburg), Daniel Post (Virginia Polytech. Inst. and State Univ., Blacksburg), Carl T. Herakovich (Virginia Polytech. Inst. and State Univ., Blacksburg), and Darrel R. Tenny Aug. 1980 149 p refs
(Grant NGR-47-004-129)
(NASA-TM-80788; VPI-E-80-19; IR-20) Avail: NTIS HC A07/MF A01 CSCL 11D

An experimental technique for precise measurement of the thermal response of fiber-reinforced composite materials uses moire interferometry with fringe multiplication which yield a sensitivity of 833 nm (32.8 mu in.) per fringe. Results from the technique are compared with those obtained from electrical resistance strain gages, and also those predicted from classical lamination theory. Temperature dependent coefficients of thermal expansion for composite materials subjected to thermal cycling in the temperature range of 297 K (75 F) to 422 K (300 F) were determined for four laminate configurations ([0], [90], [0/ + or - 45/90] sub s and [0/90/ + or - 45] sub s) of T300/5208 graphite epoxy, and ranged from -0.107 mu epsilon K/1 (-0.059 mu epsilon deg F/-) for the [0] laminate to 32.18 mu epsilon K/1 (17.88 mu epsilon F/1) for the [90] laminate. Moisture was found to greatly influence the thermal response of a quasi-isotropic laminate, resulting in hysteresis and residual compressive strain as the moisture content was reduced. Comparisons between moire and strain gage measurements were inconclusive with both techniques giving consistent but systematically different results. Differences of as much as 29% were observed. A.R.H.

N80-29430*# Fiber Materials, Inc., Biddeford, Maine.
FABRICATION AND EVALUATION OF LOW FIBER CONTENT ALUMINA FIBER/ALUMINUM COMPOSITES Final Report
J. E. Hack and G. C. Strempek 18 Jun. 1980 72 p refs
(Contract NAS3-21371)
(NASA-CR-159517; AMDL-0001) Avail: NTIS HC A04/MF A01 CSCL 11D

The mechanical fabrication of low volume percent fiber, polycrystalline alumina fiber reinforced aluminum composites was accomplished. Wire preform material was prepared by liquid-metal infiltration of alumina fiber bundles. The wires were subsequently encapsulated with aluminum foil and fabricated into bulk composite material by hot-drawing. Extensive mechanical, thermal and chemical testing was conducted on preform and bulk material to develop a process and material data base. In addition, a preliminary investigation of mechanical forming of bulk alumina fiber reinforced aluminum composite material was conducted. Author

N80-29431*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL RELEASE OF FIBERS FROM BURNING CARBON COMPOSITES
Vernon L. Bell Jul. 1980 52 p refs
(NASA-TM-80214) Avail: NTIS HC A04/MF A01 CSCL 11D

A comprehensive experimental carbon fiber source program was conducted to determine the potential for the release of conductive carbon fibers from burning composites. Laboratory testing determined the relative importance of several parameters influencing the amounts of single fibers released, while large-scale aviation jet fuel pool fires provided realistic confirmation of the laboratory data. The dimensions and size distributions of fire-released carbon fibers were determined, not only for those of concern in an electrical sense, but also for those of potential interest from a health and environmental standpoint. Fire plume and chemistry studies were performed with large pool fires to provide an experimental input into an analytical modelling of simulated aircraft crash fires. A study of a high voltage spark system resulted in a promising device for the detection, counting, and sizing of electrically conductive fibers, for both active and passive modes of operation. Author

N80-29432*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
STATISTICAL ASPECTS OF CARBON FIBER RISK ASSESSMENT MODELING
Donald Gross, Douglas R. Miller, and Richard M. Soland Jul. 1980 127 p refs
(Contract NsG-1556)

(NASA-CR-159318) Avail: NTIS HC A07/MF A01 CSCL 11D

The probabilistic and statistical aspects of the carbon fiber risk assessment modeling of fire accidents involving commercial aircraft are examined. Three major sources of uncertainty in the modeling effort are identified. These are: (1) imprecise knowledge in establishing the model; (2) parameter estimation; and (3) Monte Carlo sampling error. All three sources of uncertainty are treated and statistical procedures are utilized and/or developed to control them wherever possible. A.R.H.

N80-29433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF EXCESS DIAMINE ON PROPERTIES OF PMR POLYIMIDE RESINS AND COMPOSITES

Francis I. Hurwitz 1980 15 p refs Proposed for presentation at 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980 (NASA-TM-81580; E-550) Avail: NTIS HC A02/MF A01 CSCL 11D

By varying the stoichiometry of the reactants in the preparation of PMR polyimide resin, changes occur in molecular weight distribution which influence the rheological properties and thus the processability of the resin, as well as the mechanical properties of the composite. The influence of 1-10 percent molar excess MDA on the molecular weight distribution and rheological properties of an imidized PMR system were exposed. Molecular weight distribution is characterized by gel permeation chromatography of the imidized molding compound; shear viscosity is related to changes in average molecular weight. The thermo-oxidative stability at 600 F, glass transition temperature, flexural and interlaminar shear properties of PMR polyimide/Celion 6000 graphite fiber composites are compared as a function of the percent excess MDA in the monomer reactant mixture. A.R.H.

N80-29434# Washington Univ., St. Louis, Mo. Materials Research Lab.

STRENGTH DEGRADATION OF ARAMID-FIBER/EPOXY COMPOSITES Final Report

Edward M. Wu Apr. 1980 50 p refs (Contract DAAG46-75-C-0081; DA Proj. 1T1-62105-AH-84) (AD-A085670; AMMRC-TR-80-19) Avail: NTIS HC A03/MF A01 CSCL 11/4

The moisture absorption kinetics for Kevlar 49 epoxy have been measured for four environmental conditions. The strength degradation for the composite has been systematically measured by six experiments for each of the four states. The tensor polynomial strength coefficients are generalized to represent the strength degradation for the moisture absorbed states. Due to the big difference between tensile and compressive strength for Kevlar 49 composites, analytical representation of the failure surface requires a third-order tensor polynomial. Four additional biaxial experiments are needed to provide the necessary data. The degree of fiber-controlled strength degradation is different from the degradation of matrix-controlled strength, which causes the failure surface to shift and deform. This shift should also be characterized by a third-order tensor polynomial. GRA

N80-29435# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.

UTILITY OF PROBABILITY DENSITY FUNCTION CURVE AND F-MAPS IN COMPOSITE MATERIAL INSPECTION Annual Report

Joseph L. Rose, Yi H. Jeong, and Michael J. Avioli 13 Feb. 1980 25 p refs (Contract N00014-77-C-0607) (AD-A085803; AR-1) Avail: NTIS HC A02/MF A01 CSCL 11/4

The subject of probability density function analysis, an important topic in statistical analysis, is studied in detail in this paper for its utility in nondestructive testing. In addition to the mathematical concepts and analysis, several sample problems in composite material inspection are presented. An F-map, or feature map, presentation is also presented that gives us a new way to examine composite materials. A probability density function basically gives us a plot of the number of times that a particular feature is recorded versus the feature value itself, a feature being defined as a specific item related to an ultrasonic waveform, possibly center frequency, attenuation at a particular frequency, etc. Probability density function curves are also used to set threshold values in producing an F-map. Sample problems in a graphite polyimide structure and a boron aluminum material are covered. GRA

N80-29436# Atomic Energy Research Establishment, Harwell (England). Non-destructive Testing Centre.

NONDESTRUCTIVE EXAMINATION OF COMPOSITE MATERIALS: A SURVEY OF EUROPEAN LITERATURE Final Technical Report, Oct. 1979 - Feb. 1980

William N. Reynolds May 1980 89 p (Contract DAAJ37-79-C-0553; DA Proj. 1T1-61102-BH-57) (AD-A086165) Avail: NTIS HC A05/MF A01 CSCL 11/4

The references corresponding to the nondestructive examination of fibre reinforced composite materials have been retrieved from the Harwell NDT Centre information system and all those relating to European work have been examined. This has produced a comprehensive list of techniques used and of institutions and companies which have so far played an active part in the field. Apart from the relatively few industries which have met the need to develop testing procedures for composite materials in production or use, a much larger number of universities and research organizations have carried out fundamental studies of the problems involved which enable some calculations to be drawn about the outstanding difficulties. These include some useful reviews of the subject. In addition, samples of composite materials have been included in some general testing programmes, and references to a number of these are included. GRA

N80-29437# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

FAILURE ANALYSIS OF COMPOSITE LAMINATES WITH FASTENER HOLE Final Report, 15 Sep. 1978 - 1 Aug. 1979

Som R. Soni Mar. 1980 49 p refs (AD-A085858; AFWAL-TR-80-4010) Avail: NTIS HC A03/MF A01 CSCL 11/4

Stress and strength analysis of composite laminates with a through the thickness circular hole, under uniaxial tensile load has been conducted. The hole is filled with a rigid core simulating a bolt. As a representation of the force at the bolted joint, displacement boundary conditions are applied to the rigid core. The stress analysis is based on treating the laminate as a homogeneous plate using finite element technique. The strength analysis is based on the tensor polynomial failure criterion applied to each constituent ply orientations. The ultimate laminate failure strength is based on the last ply failure stress. The resulting predictions of strength are found to be conservative as compared to experimental values. GRA

N80-29438# McDonnell Aircraft Co., St. Louis, Mo. Structural Research Dept.

COMPRESSION FATIGUE LIFE PREDICTION METHODOLOGY FOR COMPOSITE STRUCTURES: LITERATURE SURVEY Interim Report, Oct. 1979 - Jan. 1980

C. R. Saff Jun. 1980 77 p refs (Contract N62269-79-C-0214) (AD-A086062; NADC-78203-60) Avail: NTIS HC A05/MF A01 CSCL 11/4

This report summarizes literature concerning static strength and fatigue analysis of bolted jointed in composite materials. The literature survey was a portion of the first Task of the Navy Contract N62269-79-C-0214, 'Compression Fatigue Life Prediction Methodology for Composite Structures'. The objective of this program is to develop a fatigue life prediction methodology that will improve design efficiency, facilitate structural certification and provide guidelines for service life management. This survey provides a basis for formulation of the experimental and analytical programs to be performed in later tasks. GRA

N80-29439# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

METAL MATRIX COMPOSITE BONDING CHARACTERISTICS AND IMPACT PROPERTIES Final Report, 1 Mar. 1977 - 29 Feb. 1980

Robert G. Carlson 30 Apr. 1980 47 p refs (Contract F49620-77-C-0067; AF Proj. 2306)

(AD-A085853; R80AEG345; AFOSR-80-0453TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

This research program objective is to develop an understanding of the surface characteristics and bond behavior in metal matrix composites as related to the impact properties. The initial part of this program addresses itself to bonding of aluminum foils with different surface treatments. Scanning electron micrographs revealed the presence of Al/Fe compounds. Following this, extensive efforts were directed at identifying an etchant to remove such heterogeneous phase identified to be an aluminum iron compound, Al3Fe. After an extensive literature review, three chemical etchants were selected, the aluminum alloy foils were chemically tested, and the etched foils were evaluated by scanning electron microscopy. Single layered monotapes were then formed and evaluated by bond integrity testing (BIT). Following this, further studies were performed on evaluation of hybrid metal/metal foil combinations consisting of aluminum alloy foils against titanium or stainless steel foils. The study was next directed at fabrication of single-ply boron/aluminum panels and then in formation of hybrid titanium/aluminum/boron (TAB) and stainless steel/aluminum/boron (SAB) single-ply panels. GRA

N80-29440# Queen Mary Coll., London (England). Dept. of Materials.

ENVIRONMENTAL FAILURE OF ADHESIVE BONDING IN COMPOSITES Final Annual Report, Sep. 1978 - Dec. 1979

E. H. Andrews, Ho Ping Sheng, H. A. Majid, and C. Vlautos Mar. 1980 21 p refs

(Contract DA-ERO-78-G-118; Da Proj. 1T1-61102-BH-04)

(AD-A085878; FAR-1) Avail: NTIS HC A02/MF A01 CSCL 11/4

The adaptation of the Andrews-Stevenson (A-S) adhesion test, previously used for epoxy to metal adhesive systems, for epoxy-to-glass bonds has been achieved for epoxy resins having relatively low T sub g's (e.g. Epikote 828, T sub g = 71 C). Partial success has been achieved for high T sub g resins (e.g. SP250). This adaptation has required considerable sophistication of test-piece geometry to prevent thermal contraction stresses shattering the glass substrates during specimen preparation. The effect of water immersion at 80 C for various periods of time has been studied for the system Epikote 828 pyrex glass in the absence of coupling agents. The fracture mode becomes increasingly cohesive as immersion time increases and the peak in the curve of fracture energy versus crack speed falls progressively. Using Andrews' generalized theory, the adhesive fracture energy theta can be separated into its interfacial energy and dissipative components. GRA

N80-29441# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.

REDUCTION OF ELASTIC MODULI OF FIBER COMPOSITES BY FATIGUE CRACK ACCUMULATION

T. Gottesman, Zvi Hashin, and M. A. Brull 15 Apr. 1980 18 p refs

(Contract N00014-78-C-0544)

(AD-A085995; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/4

The problem of reduction of elastic moduli of unidirectional fiber composites due to parallel cracks, either parallel or normal to fibers, is considered on the basis of variational techniques. Expressions for effective elastic moduli are given for the case of a small number of non-interacting cracks. It is shown that these are upper bounds on effective elastic moduli for the case of arbitrary distributions of parallel cracks. Lower bounds for Young's moduli for special parallel crack distributions are also constructed. In addition, the 'self consistent scheme' approximation is also applied to the present problem. The problem treated is of significance for fatigue damage of fiber composites since such damage consists primarily of formation of such cracks. Experimental determination of moduli reduction due to cyclic stress (wearout) can thus provide a measure of the number of cracks formed. GRA

N80-29442# Executive Office of the President, Washington, D. C. Office of Science and Technology Policy.

CARBON/GRAPHITE COMPOSITE MATERIAL STUDY Annual Report, 1979

15 Mar. 1980 67 p

(PB80-175235; AR-2) Avail: NTIS HC A04/MF A01 CSCL 11E

Progress is reported by NASA, DOT, DOD, OSHA, and NIOSH in assessing the potential effects of accidentally released carbon fibers on electronic equipment in aircraft, surface vehicles, commercial institutions, and households as well as on power generation and distribution facilities. The impact on municipal solid waste disposal facilities is also considered along with methods for environmental monitoring and for determining health related problems in industries. The modification of carbon/graphite fibers and the use of alternate materials is discussed. A market analysis of U.S. manufacturers is included. A.R.H.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-29443 Arizona Univ., Tucson.

THE CHARACTERIZATION OF BONDED PHASES FOR HIGH PERFORMANCE LIQUID CHROMATOGRAPHY Ph.D. Thesis

Klaus John Stetzenbach 1980 169 p

Avail: Univ. Microfilms Order No. 8017813

The physical and chemical nature of chemically bonded phases used in high performance liquid chromatography were studied. These bonded phases were characterized by a variety of chromatographic and nonchromatographic experiments. The nonchromatographic techniques included C-13 nuclear magnetic resonance and batch extraction methods. The role played by the bonded phase as well as the mobile phase in determining the retention characteristics of the stationary phase were determined. The retention of solute molecules on bonded phases was found to be a function of the chain length of the bonded phase, the chemical nature of the bonded molecule, and the type of organic modifier used in the mobile phase. The energetics of the solute stationary phase interactions was determined by the differential enthalpy and was found to be indicative of a partitioning process between two liquid phases. Results show that the stationary phase consists of the bonded molecule as well as trapped mobile phase. The composition of this ternary mixture is a function of the type and amount of bonded material and the type and amount of organic modifier used in the mobile phase. Dissert. Abstr.

N80-29444 Michigan Univ., Ann Arbor.

OPTICAL EMISSION SPECTROSCOPY OF UNIFORM AEROSOL DROPLETS IN A HYBRID FLAME/ARC EXCITATION SOURCE Ph.D. Thesis

Charles Ernest Schmidt 1980 209 p

Avail: Univ. Microfilms Order No. 8017361

Plasma jets and gas stabilized arcs are investigated for dc arc emission spectroscopy. Gas stabilized arcs utilize gas streams to shape the dc discharge maintained between two sharp rod electrodes. Low Ar cooling gas flow rate (1.3 l/min) results in a larger more diffuse plasma. At 3.9 l/min the plasma is smaller and the bent arc conduction channel is visable. Gas flow rates determine the aerosol-plasma compatibility. Aerosol penetration of the discharge is achieved with a hybrid excitation source which combines a cylindrical N2O/C2H2 flame with the Elliot bent arc. Solution is introduced into the flame as discrete, uniform, monodisperse droplets 40 to 90 microns in diameter. The flame, operated at oxidant/fuel ratio of about 2, desolvates, atomizes, accelerates, and directs the solution aerosol. The system is operated to produce a cone of vaporizing/emitting analyte atoms inside the arc plume about 1 to 3 mm above the arc conduction channel. Line-to-background ratios of about 10 are found as compared to values less than 1 when the analyte atom cone is located below the arc apex. Analytical curves are linear for concentrations between 100 and 0.5 ppm. Detection limits are in the low ppb range. Dissert. Abstr.

N80-29445 Michigan Univ., Ann Arbor.
DEVELOPMENT AND EVALUATION OF COHERENT RAMAN SPECTROSCOPY IN THE CONDENSED PHASE Ph.D. Thesis
Gary Patrick Ritz 1980 189 p
Avail: Univ. Microfilms Order No. 8017347

The development and evaluation of two coherent Raman techniques (coherent anti-Stokes Raman spectroscopy and ac-coupled inverse Raman spectroscopy) is discussed. Also, a detailed description of a microprocessor-controlled data acquisition system for pulsed laser spectroscopy is given. From the basic theory behind the nonlinear response of matter to intense electric fields, the generation of coherent anti-Stokes Raman spectroscopy (CARS) is derived in order to describe its drawbacks and unusual effects. Particular attention is paid to the aqueous solution detection limits of CARS, which are about 100 times higher than those obtained by spontaneous Raman. The ac-coupled inverse Raman spectroscopy technique is shown to give spectra which are exactly analogous to spontaneous Raman spectra. Suitable experimental conditions for this technique are discussed and aqueous solution detection limits only 5 times higher than those for spontaneous Raman spectroscopy are demonstrated. Theoretical calculations indicate that detection limits 50 times lower than spontaneous Raman limits may be achieved using refined procedures and apparatus. Dissert. Abstr.

N80-29446 Duke Univ., Durham, N. C.
CHEMICALLY REVERSIBLE COVALENTLY BONDED STATIONARY PHASES FOR LIQUID CHROMATOGRAPHY Ph.D. Thesis
Susan Marshall 1980 150 p
Avail: Univ. Microfilms Order No. 8017146

Four polyazanaphthalene chemically bonded stationary phases were synthesized and characterized. A series of bonded phases, in which the number of nitrogen atoms increase from one (quinoline) to three (1,3,8-triazanaphthalene), was studied with a two fold objective: (1) to study a new family of potential charge-transfer acceptors for incorporation into a bonded phase; and (2) to develop a chemically bonded stationary phase in which the selectivity of the bonded phase could be varied through chemically reversible modification of the bonded organic moiety. Chemical reversibility of the bonded phase was achieved via pH modification of the mobile phase. In order to clarify the pH dependent behavior of the chemically bonded polyazanaphthalene stationary phases, the pH dependent solution in the four bonded phases, model compounds of the bonded organic moieties were synthesized. Dissert. Abstr.

N80-29447 State Univ. of New York at Stony Brook.
PHASE TRANSITIONS IN FeS AT HIGH-TEMPERATURES AND HIGH PRESSURES Ph.D. Thesis
Hubert Ellis King, Jr. 1979 192 p
Avail: Univ. Microfilms Order No. 8009601

The results of single crystal X-ray diffraction electrical resistivity and 57FE Mossbauer spectra measurement across several polymorphic transitions of FeS at elevated temperatures and pressures are given. In addition, a tentative pressure temperature phase diagram for FeS is presented. Room temperature 57FE Mossbauer spectra were measured on powdered samples enclosed with a diamond cell at pressures up to 142 kbar. Two transitions were observed. The 34 kbar transition results in a decrease in the magnetic exchange interaction with a negligible change in electron distribution. The 67 kbar transition causes a substantial redistribution of electrons and destroys the magnetic ordering. X-ray diffraction measurements show that at both the 140 C transition and the 34 kbar one, troilite transforms to a MnP-type structure. Refinement of the structures before and after the transition show that the MnP-type structure is less distorted than that of troilite. However, the high pressure MnP-type structure is more distorted than the one at high temperature. At higher temperatures, the MnP-type structure undergoes a second order transition to a NiAs type structure. Electrical resistivity measurements show that transition, FeS becomes a high resistance metal with nearly temperature independent resistivity. Dissert. Abstr.

N80-29448 Rice Univ., Houston, Tex.
DESIGN AND DEVELOPMENT OF GENERALIZED APPARATUS TO STUDY THE PHASE AND VOLUMETRIC BEHAVIOR OF PURE COMPONENTS AND MIXTURES AT ADVANCED TEMPERATURES AND PRESSURES, AND ANALYTICAL EXAMINATION OF THE RESULTING OBSERVATIONS Ph.D. Thesis
Parvaiz Nasir 1980 179 p
Avail: Univ. Microfilms Order No. 8018073

A generalized apparatus was designed and developed to measure high temperature high pressure vapor liquid equilibrium (VLE) gas solubility, and pressure volume temperature (PVT) data for compounds and mixtures which are of interest in coal liquefaction processes. The heart of the apparatus was a novel variable volume equilibrium cell which consisted of a precision positive displacement pump in which the pump cylinder itself was utilized as the equilibrium cell. VLE data on H2 Tetralin systems were measured at 150, 189.6, and 268.7 C. The pressure range was 19.5 to 321.43 atm. The solubility of H2 in m 2-epthylanthraquinone was measured at 150 to 224.6 C. Compressibility factors were measured for benzene at 158.56, 181.58, and 202.64 C. The saturated molar volumes at each temperature were obtained from the intersection of each isotherm with the respective vapor pressure. Dissert. Abstr.

N80-29449 Michigan Univ., Ann Arbor.
MODIFICATION OF THE CATALYTIC PROPERTIES OF IRON AS DETERMINED BY MOESSBAUER SPECTROSCOPY Ph.D. Thesis
Shrihari Vasudeva Borcar 1980 209 p
Avail: Univ. Microfilms Order No. 8017223

The techniques of conversion electron Moessbauer spectroscopy (CEMS) and Transmission Moessbauer Spectroscopy (TMES), were used in heterogeneous catalysis research to study the influence of metallic additives to Fe. Two separate studies were conducted with CEMS, one dealing with Fe57/Fe56/quartz film sandwiches, and the other dealing with Fe, Fe-Pd, Fe-Au thin films. The TMES study was used to determine the extent of bimetallic cluster formation in supported bimetallic systems. The reactions studied were NH3 decomposition, NO decomposition and NO reduction by H2. Dissert. Abstr.

N80-29450 Rice Univ., Houston, Tex.
AN ANALYSIS OF MELTING WITHIN A HORIZONTAL CYLINDRICAL ENCLOSURE Ph.D. Thesis
Dianne Wheatley Nicholas 1980 95 p
Avail: Univ. Microfilms Order No. 8018077

The melting process for a phase change material in which the solid density is greater than that of the liquid was examined. The effect of unequal densities on the shape and location of the solid liquid interface for a system within a horizontal cylindrical enclosure was investigated. This model offered a solution for the coupled conduction and interface balance equations for the three problems of constant wall temperature, constant heat flux, and constant heat transfer coefficient imposed at the cylinder surface. The numerical method of finite difference was used to solve the system of governing equations. In the solution of the conduction equation, the implicit alternating direction technique was implemented. It is proposed that the heavier solid phase drops to the base of the cylinder as it melts, and maintains a position antisymmetric with respect to the cylindrical axis. To check the validity of this, experimental tests were made in which the interface position was photographed at selected time intervals. These photographs indicated that the mathematical model is physically justified. Dissert. Abstr.

N80-29451 Catholic Univ. of America, Washington, D. C.
COMPOSITION AND TEMPERATURE DEPENDENCE OF SHEAR VISCOSITY OF HYDROCARBON MIXTURES Ph.D. Thesis
Mohammad Adel Hadadi 1980 106 p
Avail: Univ. Microfilms Order No. 8018359

The effects of temperature and composition on the shear viscosities of blends of hydrocarbons of the type found in jet fuel kerosenes was investigated. The combined temperature composition dependence of viscosities of five pure C10 hydrocarbons and their different mixtures and of binary C10-C14 hydrocarbon system were studied, and the results evaluated. Dissert. Abstr.

N80-29452 Michigan Univ., Ann Arbor.
INSTRUMENTATION FOR COHERENT RAMAN SPECTROSCOPY Ph.D. Thesis
David Joseph Wallan 1980 157 p
Avail: Univ. Microfilms Order No. 8017395

The design and construction of a pulsed dye laser for coherent anti-Stokes Raman spectroscopy (CARS) experimentation as well as the fundamental principles involved in such a project are presented. The laser is a Hansch configuration for transverse nitrogen laser pumping. It includes an intracavity polarizer, beam expanding telescope and diffraction grating end reflector. Typical output powers are about 15 kW, with a spectral bandwidth of about 0.05 nm. The CARS peak height ratios, variable bandshapes, band interference effects and polarized spectra are shown and their relationship to spontaneous Raman spectroscopy is discussed. The complex concentration dependence of CARS signal intensity is also demonstrated using aqueous KNO3 solutions. A concentration series from 2.6 M down to a detection limit of 0.05M is used to show a linear calibration curve at low concentrations and a square law dependence for more concentrated solutions. Dissert. Abstr.

N80-29453 Connecticut Univ., Storrs.
AN ESR STUDY OF RADICALS IN A ZEOLITE MATRIX Ph.D. Thesis
David Edward Audette 1979 180 p
Avail: Univ. Microfilms Order No. 8017011

Electron Spin Resonance (ESR) studies were done on simple olefinic compounds adsorbed in cation exchanged synthetic zeolites, primarily cerium exchanged Y type zeolite. It was observed that a low concentration of olefin gave rise to additional hyperfine structure. However, this fine structure was not resolvable when the concentration was increased. Studies of the time dependence of this fine structure indicate complex radicals are formed by radical reaction. Due to characteristic differences in ESR structure, which were related to the olefin structure, one can rule out radical-zeolite interaction as the cause of the fine structure. Measurements on the quantity of radicals produced from known amounts of adsorbed olefin were made to determine the extent of radical reaction or interaction. Some radical structures were proposed as possible explanations for the spectra observed but the actual structure could not be conclusively assigned. Dissert. Abstr.

N80-29454 Florida State Univ., Tallahassee.
MAGNETIC CIRCULAR DICHROISM OF METAL OXIDES ISOLATED IN NOBLE GAS MATRICES Ph.D. Thesis
David Hinton Powell 1979 193 p
Avail: Univ. Microfilms Order No. 8016573

The diatomic oxides of Groups 4B and 5B were isolated by condensation of a molecular beam of the monoxides with rare gases at 14 K. Zero field absorbance (ZFA) and magnetic circular dichroism (MCD) spectra were obtained for all six molecules. The results obtained for TiO, ZrO and HfO were analyzed. An apparatus for the preparation of rare gas matrices containing high temperature metal oxides was constructed. The ZFA and MCD spectra were obtained using a computer controlled system, and data were stored on magnetic tape cassettes. The ZFA spectra were obtained using a double beam technique employing a single detector, two light beams modulated at different frequencies, and two lock in amplifiers. The MCD spectra were obtained using a low field electromagnet (5500 gauss), a photoelastic modular, and a feedback circuit which controlled the detector gain to correct for variations in the background light intensity. Dissert. Abstr.

N80-29455 Connecticut Univ., Storrs.
THE APPLICATION OF COUPLED CHROMATOGRAPHY TO THE ANALYSIS OF ANTIOXIDANTS IN POLYOLEFINS Ph.D. Thesis
Robert Bernard Walter 1980 193 p
Avail: Univ. Microfilms Order No. 8017036

An extractionless method for the analysis of multicomponent stabilized systems in polyolefins is described. The technique involves coupling preparative exclusion chromatography with analytical high performance liquid solid chromatography. The literature on lifetime prediction of antioxidant efficacy in polymers is critically reviewed. Methods employed for analyzing antioxidants are presented, with a compilation of previous liquid chromatographic applications. Dissert. Abstr.

N80-29456 Connecticut Univ., Storrs.
FUNDAMENTAL STUDIES OF THE EFFECT OF VARIOUS STRESSES ON THE MOLECULAR WEIGHT AND THE MOLECULAR WEIGHT DISTRIBUTION OF POLYOLEFINS Ph.D. Thesis
Chaisagna Taerstanachai 1979 217 p
Avail: Univ. Microfilms Order No. 8017064

Factors affecting the precision of high temperature gel permeation chromatography were analyzed by comparison of results from various chromatographs. The instrumentation, experimental procedure and method of calibration were evaluated. Ultrahigh molecular weight polymers were tested for thermal stability during high temperature operation. The effect of permeation process and shear degradation in the column were determined. The combined effects of thermal and shear stresses on the molecular weight and the molecular weight distribution from extrusion experiments were carried out by high temperature gel permeation chromatograph. Aged cables that failed in service with various length of time due to the combined effects of electrical and environmental stresses were examined. Measurements of the molecular weight and comparison were made for the controlled cable samples and the cables that failed in service to elucidate the change in the internal structure of polyolefins during the course of degradation. Dissert. Abstr.

N80-29457 Illinois Univ., Urbana-Champaign.
***PICOSECOND STUDIES OF UNIMOLECULAR REACTIONS* Ph.D. Thesis**
Kevin Konrad Smith 1980 273 p
Avail: Univ. Microfilms Order No. 8017985

The construction of an apparatus which allows resolution of events on the picosecond timescale was investigated. The streak camera was used as the primary detector. Video detection was used to detect signals from the streak camera. A two dimensional digitizer was used to acquire the data from the video detector. This data was then fed to a microcomputer which stores, analyzes and displays the digitized signals. Use of a computer interactive with the two dimensional digitizer allowed large signal to noise enhancements. Dissert. Abstr.

N80-29458 Lawrence Univ., Appleton, Wis.
GAS-CHROMATOGRAPHIC CHARACTERIZATION OF ADSORBENT CELLULOSE SURFACES Ph.D. Thesis
Peter August Mazurak 1979 161 p
Avail: Univ. Microfilms Order No. 8017863

An approach for characterizing adsorbent surfaces based on direct use of gas chromatographic retention data was studied. A surface adsorption index (SAI) was defined as the difference in retention volumes between large and very small injections of adsorbate on an adsorbent packed column. Mechanisms of absorbate transport along the column are considered and it is shown that the proposed SAI values should be predominately influenced by sorbate-surface interactions. The general behavior of surface adsorption indices was investigated and SAI characterization of a surface was compared with results of thermodynamic analyses of adsorption isotherms. Results have shown SAI values to be strongly dependent on adsorbate-adsorbent interactions. The SAI values were found to be directly proportional to adsorbent mass and specific surface area. These indices were independent of carrier gas flow rate, density of column packing, or column length as long as the column diameter remained constant. Temperature dependence was neither linear nor logarithmic since various thermal factors influenced transport of different concentrations of adsorbate along the column. Dissert. Abstr.

N80-29459 Illinois Univ., Urbana-Champaign.
RAMAN SPECTROSCOPY OF DENSE FLUIDS. TEMPERATURE AND PRESSURE EFFECTS ON VIBRATIONAL RELAXATION, MOLECULAR-REORIENTATION AND SPECTRAL FREQUENCIES Ph.D. Thesis
Paul Theodore Sharko 1980 157 p
Avail: Univ. Microfilms Order No. 8017980

This work reports measurements of the Raman spectra of the Si-CH3 and C-H stretching modes of tetramethylsilane, the C-H stretching mode of fluoroform, and the C = O stretching

mode of acetone. All spectra were measured under independently varied conditions of temperature and pressure. The isotropic spectra of tetramethylsilane were measured at temperatures from 0 to 100 C and at pressures up to 4000 bar. It was found that the spectral widths of the Si-CH3 stretching mode are determined by a dephasing mechanism of vibrational relaxation but the widths of the C-H stretching mode are determined by inhomogeneous vibrational broadening. The pressure and temperature dependence of vibrational frequency are also tabulated and are found to follow a trend similar to that seen in other molecules. Both polarized and depolarized spectra of fluoroform were taken from 0 to 100 C and at pressures up to 2000 bar. The pressure and temperature dependence of the isotropic spectral widths were found to agree well with the predictions of the vibrational dephasing mechanism. Dissert. Abstr.

N80-29460# Materials Research Labs., Melbourne (Australia).
THE DENSITY OF SEAWATER: SOME PRACTICAL RELATIONSHIPS
Daniel J. Whelan May 1980 22 p refs
(MRL-TN-437; AR-002-158) Avail: NTIS HC A02/MF A01

Traditionally, the density of seawater as a function of temperature and salinity at atmospheric pressure is discussed in terms of the density function, Sigma-T. Some simplified mathematical relationships are presented from which changes in Sigma-T can be predicted from changes in temperature and salinity. However, density is also affected by pressure and an accurate treatment of the density of seawater within a deep ocean water mass requires a more sophisticated approach. One such treatment and the results obtained from it are outlined. A.R.H.

N80-29461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPECTROSCOPIC STUDY OF INTERMEDIATES IN THE CONDENSATION OF REFRACTORY SMOKES: MATRIX ISOLATION EXPERIMENTS SiO
Raj K. Khanna (Maryland Univ., College Park), David D. Stranz (Maryland Univ., College Park), and D. Donn [1980] 28 p
(Grant NsG-5172)
(NASA-TM-81128) Avail: NTIS HC A03/MF A01 CSCL 07D

The infrared and Raman spectra of N2 matrix isolated silicon oxides are investigated. The vibrational frequencies of SiO, Si2O2, and Si3O3 were identified and assigned on the basis of normal coordinate analyses. Heating the solid to 50 K (evaporating the matrix) leaves a residue whose infrared spectrum is identical to that of a smoke condensed at ambient temperatures. Further heating of the sample to 500 K leads to significant changes in the band shapes. Investigations of the infrared spectra at several stages of the diffusion process result in the proposal of a mechanism for the transition from molecular properties to those of the residue (bulk) material, which is characterized as Si2O3. M.G.

N80-29462*# Maryland Univ., College Park. Dept. of Chemistry.
ABSORPTION AND RESONANCE RAMAN SPECTRA OF Pb2, Pb3 AND Pb4 IN XENON MATRICES
David D. Stranz and Raj K. Khanna [1980] 16 p refs
(Grant NsG-5172)
(NASA-CR-163428) Avail: NTIS HC A02/MF A01 CSCL 07D

Lead metal was vaporized and trapped in solid xenon at 12K. Electronic absorption and resonance Raman spectra were recorded of the resulting matrix, which was shown to contain Pb2, Pb3, and possibly Pb4 molecular species. The vibrational frequency for Pb2 is determined to be 108/cm for the ground state, with a dissociation energy of 82000/cm. Ad3h symmetry is indicated for the Pb3 species, with nu sub 1 - 117/cm and nu sub 2 - 96 /cm. The existence of Pb4 is suggested by a fundamental and overtone of 111/cm spacing. Author

N80-29463*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE SPECTRAL OPACITY OF TRIATOMIC CARBON MEASURED IN A GRAPHITE TUBE FURNACE OVER THE 280 TO 600 nm WAVELENGTH RANGE
Walter L. Snow and William L. Wells Jul. 1980 24 p refs
(NASA-TM-81837) Avail: NTIS HC A02/MF A01 CSCL 07D

The opacity of linear triatomic carbon (C3) was measured in a graphite tube furnace from 280 to 600 nm to supplement the earlier measurements of Brewar and Engelke. The spectral cross section was estimated from the opacities using temperature profiles determined pyrometrically and a revised heat of formation delta H = 198 kcal/mole). The cross section was found to be nonnegligible over the range 300 to 500 nm and the electronic oscillator strength based on the total cross section estimate was 0.02. Author

N80-29464# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTPOLYTIC SEPARATION OF AL3Ni FIBERS FROM THE EUTECTIC ALLOY, AlAl3Ni
Kenneth P. Quinlan and Joseph J. Hutta Dec. 1979 25 p refs
(AF Proj. 2306)
(AD-A085569; RADC-TR-79-329) Avail: NTIS HC A02/MF A01 CSCL 07/4

An electrolytic procedure was developed to remove the trialuminum nickel fibers from the aluminum matrix in the eutectic alloy, Al-Al3Ni. The procedure consists of electrolyzing the aluminum matrix at potentials ranging from -0.8 to -0.5 volt (vs. S.C.E.) in a 1M potassium hydroxide electrolyte. Scanning electron photomicrographs showed that the separated Al3Ni fibers are intact. Anodic polarization studies with aluminum-nickel alloys illustrated that the presence of nickel protects aluminum from oxidation. Studies with a special fabricated platinum electrode demonstrated that the Al3Ni fibers are not oxidized within the potential range of -0.8 to -0.5 volt (vs S.C.E.) in a 1M potassium hydroxide electrolyte. This decreased rate of oxidation of aluminum in the Al3Ni fibers is correlated with the low rate of diffusion of the aluminum in the Al3Ni orthorhombic crystals. The procedure does not require the stringent conditions as in other methods of producing Al3Ni fibers from eutectic alloys. The method has the additional advantage of being applicable to a continuous process where the fibers can be removed and the electrolyte replenished. GRA

N80-29465# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
MULTICOLOR ELECTROCHROMIC DOT-MATRIX DISPLAY INVESTIGATION Final Report, 1 Jul. 1979 - 31 Mar. 1980
M. M. Nicholson, F. A. Pizzarello, and T. J. LaChapelle Jun. 1980 51 p refs
(Contract N00014-79-C-0434)
(AD-A085453; C80-325/501) Avail: NTIS HC A04/MF A01 CSCL 07/4

The feasibility of multicolor electrochromic dot-matrix displays based on lutetium diphthalocyanine was investigated on the premise that integrated matrix drive electronics for such devices will become available in several years. A 3 x 3 inch display panel with switchable 5 x 7 dot characters was attractive and clearly legible at 24 lpi. Viewing was hardly impaired when a metal mesh overlay simulating the appearance of matrix drive circuitry was placed in registry with the dot pattern. Color resolution and memory were demonstrated for adjacent red/green, blue/green, and red/blue areas in the matrix. Current and charge transients were recorded for constant-voltage pulses applied to areas representing 2 to 16 dots. Time constants of 10 to 20 ms were typical of the green-to-red electrochromic transition. An effective capacitance of approximately 1000 microform/sq cm arose from the electrochemical reaction of the dye film. Also associated with that process was an area resistance, usually less than 25 ohms sq cm. Further development of multicolor electrochromic dot-matrix displays is recommended. GRA

N80-29466# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
X-RAY PHOTOELECTRON SPECTROSCOPIC STUDIES OF ELECTRODE SURFACES Final Report, 14 Jan. 1977 - 14 Dec. 1979
Nicholas Winograd 15 Apr. 1980 19 p refs
(Grant AF-AFOSR-2974-76; AF Proj. 2303)
(AD-A085311; AFOSR-80-0420TR) Avail: NTIS

HC A02/MF A01 CSCL 07/4

Emphasis is on the development of X-ray photoelectron spectroscopy (XPS) in characterizing electrochemical reaction mechanisms. The advantages of XPS to the study of electrode surfaces are the depth sensitivity to most metals is quite high with the escape length of the emitted electrons occurring only through 10-20A of the sample surface. The measured binding energies are sensitive to the oxidation state of the metal atom. Under potential deposition for the silver and copper on platinum electrodes have been examined by both XPS and Auger spectroscopy. A combination of XPS and secondary ion mass spectrometry (SIMS) was designed and connected with two satellite vacuum systems via a set of magnetically driven transfer device. This configuration allowed each technique to have its own chamber for electrode preparation. High energy ion beams were investigated for use in the ion implantation of various substrates aimed at creating new materials with unusual properties. Initial studies were focused on use of copper, silver, and gold ion beams directed toward silicon dioxide and graphite. GRA

N80-29467# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.

NITROGEN ISOELECTRONIC TRAPS IN GALLIUM ARSENIDE PHOSPHIDE AND ALUMINUM GALLIUM ARSENIDE Ph.D. Thesis

Donald James Wolford, Jr. Nov. 1979 404 p refs

(Contract N00014-79-C-0424)

(AD-A085314; R-862; UILU-ENG-78-2255) Avail: NTIS HC A18/MF A01 CSCL 07/4

The results presented here form the basis for reinterpreting N-trap luminescence in GaAs sub 1-x P sub x and Al sub x Ga sub 1-x As. Previously the luminescence of these centers in ternary alloys was attributed to NN pairs. For the isolated N center, only one bound state was identified, and that corresponded to the A-line in GaP (or AlAs). On the basis of the new data, it is now clear that dominant emission (termed N sub x) is due not to NN pairs but to isolated N and previously ignored phonon coupling. Furthermore, in GaAs sub 1-x P sub 1-x it is found an additional shallow bound state associated largely with the gamma sub 1 bend minimum is found. GRA

N80-29468# Eagle-Picher Co., Joplin, Mo. Couples Dept.

CADMIUM ELECTRODE INVESTIGATION Final Report, 16 Jul. - 4 Dec. 1979

Erwin Buck Mar. 1980 12 p refs

(Contract F33615-79-C-2056; AF Proj. 3145)

(AD-A085669; AFWAL-TR-80-2008) Avail: NTIS HC A02/MF A01 CSCL 07/4

Methods for improving the loading and utilization of active material in electrochemically impregnated cadmium electrodes were studied using sweep voltametry and galvanostatic pulse impregnation. Loading levels and utilization were found to decrease with cycling when the potentiostatic pulse method was used and impregnation times beyond one hour resulted in unacceptable surface loading. The use of galvanostatic pulse impregnation appeared to offer greater promise; however, solution composition, temperature and the pulse regime remain to be optimized. Several areas are recommended for further study including understanding of the cathodic processes, the economics of the counter electrode, solution pH control, definition of the process parameters and the effect of plaque pore morphology on loading efficiency. GRA

N80-29469# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.

ELECTRICAL CONDUCTIVITY AND INFRARED RADIOMETRY OF STEAM Special Publication, Jul. 1977 - Sep. 1978

Hugh R. Carlson Apr. 1980 33 p refs Supersedes ARCLS-TM-79006

(DA Proj. 1T1-61101-A-91A)

(AD-A085714; AD-E410262; ARCLS-SP-80006; ARCLS-TM-79006) Avail: NTIS HC A03/MF A01 CSCL 07/4

In-house laboratory independent research investigations of molecular clustering in water vapor included careful measurements of the electrical and infrared radiometric properties of steam and steam-humidified air. These measurements showed that 10 to the 6th power to 10 to the 7th power ions per cubic centimeter are present in steam or in steam-generated water vapor compared to 100 to 300 ions per cubic centimeter in water vapor under normal ambient conditions. These data, combined with infrared spectral observations of steam, are giving new insights into the understanding of the vapor-liquid phase transition in water. The results are important in meteorology, weather and climatology, and they have military implications. GRA

N80-29470# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE DETAILED MODELING OF PREMIXED, LAMINAR STEADY-STATE FLAMES TO OBTAIN VALIDATED REACTION NETWORKS. 1: OZONE

Joseph M. Heimerl and Terence P. Coffee Apr. 1980 51 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A085722; AD-E430448; ARBRL-TR-02239) Avail: NTIS HC A04/MF A01 CSCL 21/2

We have employed species dependent input coefficients for the test case ozone in a one dimensional model of a premixed, laminar steady-state flame. Convenient expressions for the input coefficients are developed. These coefficients are based on independent measurements, i.e., no arbitrary parameters are used in this model. The governing equations are solved using a relaxation technique and the partial differential equation package, PDECOL, developed by Madsen and Sincovec. Species and temperature profiles and the burning velocities are found over the range of initial ozone mole fraction of 0.25 to 1.00. The computed burning velocities are no more than 30% greater than the measurements of Streng and Grosse. Comparison with the computed results of Warnatz shows agreement within plus or minus 12%, even though he used quite different expressions for some of the kinetic coefficients. These differences are manifest in the atomic oxygen and temperature profiles at an initial ozone mole fraction of unity. A comparison of the model profiles indicates a need for measurements of ab initio calculations for the rate coefficient for the reaction 03 - 0 yields 2 02 at temperatures in the range 1500-2000 K. GRA

N80-29471# California Inst. of Tech., Pasadena. Chemistry and Chemical Engineering Div.

FUNDAMENTAL PROCESSES OCCURRING AT ELECTRODES Final Report, 1 May 1977 - 30 Apr. 1980

Fred C. Anson Jan. 1980 9 p refs

(Grant DAAG29-77-G-0092)

(AD-A086071; ARO-14577.3-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

The research program in electrochemistry reported here has concentrated on electrode kinetic studies at low ionic strengths, on methods for attaching molecules to electrode surfaces and on the electrochemical responses obtained from reactants confined to electrode surfaces. Brief summaries of the results obtained in each area are given. GRA

N80-29472# Virginia Polytechnic Inst. and State Univ., Blacksburg.

DEVELOPMENT AND APPLICATION OF ANALYTICAL TECHNIQUES TO CHEMISTRY OF DONOR SOLVENT LIQUEFACTION Quarterly Progress Report, Mar. - May 1979

A. M. Squires, H. C. Dorn, L. T. Taylor, J. G. Dillard, and P. R. Rony Sep. 1979 34 p refs

(Grant EF-77-G-01-2696)

(FE-2696-T4; QPR-7) Avail: NTIS HC A03/MF A01

Major effort concentrated on separation studies of small model compounds and selected fractions of coaly matter via gel permeation chromatography in tetrahydrofuran (THF), chloroform (CHCl3) and pyridine solvents. Molecular weights were determined for materials totally excluded and totally permeated in four soft gels which differ in percent cross-linking. A large number of compounds especially N-alkylated anilines exhibit a nonsize exclusion mechanism of separation. Exclusion limits in pyridine appears to be considerably greater than in THF or CHCl3 for n-alkanes. Results with these soft gels were compared with data obtained on rigid gels. The feasibility of nuclear magnetic

resonance (NMR) for the liquid chromatographic detection, functional group analysis via F-19 NMR of select coaly fractions, and liquefaction experiments in our micro-autoclave reactor are discussed. DOE

N80-29473# Pittsburgh Univ., Pa.
HYDROGEN DISTRIBUTION AND TRANSFER IN COAL HYDROGENATION SYSTEMS Quarterly Report, Dec. 1979 - Feb. 1980
S. H. Chiang and G. E. Klinzing Mar. 1980 9 p
(Contract DE-AC22-80PC-30014)
(DOE/PC-30014/1) Avail: NTIS HC A02/MF A01

Development of an in-situ H2 probe and experimental data of equilibrium distribution and rate of transfer of hydrogen in coal hydrogenation systems is proposed. Specific topics discussed include: (1) a thin nickel-membrane probe for in-situ hydrogen measurement; (2) equilibrium solubility data for hydrogen in coal liquids; (3) dynamic behavior and rate of hydrogen transfer in coal liquids and to examine the rate limiting steps of the process; (4) the physical/chemical effect due to the addition of coal on the equilibrium distribution of hydrogen in coal liquids; and (5) the rate of transfer of hydrogen between the gas phase and the condensed phase (which contains coal liquids and dissolved coal). DOE

N80-29474# Westgate Research Corp., Los Angeles, Calif.
AN INVESTIGATION INTO THE CHEMISTRY OF THE UV-OZONE PURIFICATION PROCESS
Erika Leitis 8 Feb. 1980 218 p refs
(Grant NSF ENV-76-24652)
(PB80-174394; NSF/RA-800023) Avail: NTIS HC A10/MF A01 CSCL 07D

The synergistic effect of ozone and UV light in the decomposition of organic compounds in water is studied. The nature and quantities of oxidation products by ozonation, UV-ozonation, and hydroxyl radical oxidation were assessed to understand the UV-ozonation mechanism. Nitrobenzene was selected as the primary model compound. This model compound followed an identical sequence of reactions in both O3 and UV/O3 oxidation via mono-, di-, and trihydroxylation of the benzene ring; the major stable intermediates were oxalic acid, formic acid, and glyocal. The ratios of O-, M-, and p-R-phenols produced by ozonation and UV-ozonation of nitrobenzene and chlorobenzene were almost identical. Various mono-, di-, tri-, and tetra-substituted benzene derivatives were studied using the oxidation regimes. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-29475 Rice Univ., Houston, Tex.
THE SINGLE CRYSTAL ELASTIC CONSTANTS OF THE TANTALUM-TUNGSTEN ALLOY SYSTEM FROM 4.2 TO 300 Ph.D. Thesis
Charles Edward Anderson 1980 149 p
Avail: Univ. Microfilms Order No. 8018028

The three single crystal independent elastic constants c sub 11, c sub 12, and c sub 44 were measured over the temperature range 4.2 K to 300 K for tantalum, tungsten and five intermediate alloys. Anomalies were found for the shear constant c sub 44 as functions of both temperature and composition. These appear to be interrelated. A similar, but less pronounced effect was found for the shear constant C prime as a function of temperature at about the same composition as for c sub 44. These anomalies were centered at approximately 50 percent tungsten. The interatomic force constants for nearest and second nearest neighbors were calculated. The Debye temperatures were calculated using the Kubic Harmonics method. The dependence upon c sub 44 for the Debye temperature calculations is reflected upon the results. No calorimetric data was available for comparison. The Ta-W system was found to be isotropic to within about 5% from 50% tungsten to pure tungsten. The system also shows a remarkable adherence to the Cauchy relation if the long range forces are considered. Dissert. Abstr.

N80-29476 Michigan Univ., Ann Arbor.
FRACTURE TOUGHNESS OF AISI M2 HIGH-SPEED STEEL AND CORRESPONDING MATRIX TOOL STEEL Ph.D. Thesis
Chongmin Kim 1980 115 p
Avail: Univ. Microfilms Order No. 8017294

The influence of microstructural variations on the fracture toughness of two tool steels with compositions 6%W-5%Mo-4%Cr-2%V-0.8%C (AISI M2 high speed steel) and 2%W-2.75%Mo-4.5%Cr-1%V-0.5%C (VASCO MA) was investigated. Samples of the two steels were heat treated to produce a wide range of microstructure, hardness, and fracture toughness values. In the as-hardened condition, the M2 steel has a higher fracture toughness than the MA steel, although the latter steel is softer. In the tempered condition, the MA steel has a higher fracture toughness than M2. When the hardening temperature is below 1095 C (2000 F), tempering of both steels causes embrittlement. Tempering results in a reduction of fracture toughness as well as hardness. The fracture toughness of both steels was found to be enhanced by increasing the grain size. Tempering temperature has no effect on the fracture toughness of M2 and MA steels as long as the fuel tempered hardness of the steels is constant. There is a temperature of austenitization for each tool steel after which the retained austenite content in the as quenched samples is a maximum. An analytical procedure for estimating volume fractions of carbides was developed. Dissert. Abstr.

N80-29477 Case Western Reserve Univ., Cleveland, Ohio.
CARBURIZATION OF LOW CARBON STAINLESS STEEL CASTING SURFACES Ph.D. Thesis
Pedro Canete Sigala 1980 144 p
Avail: Univ. Microfilms Order No. 8013832

Procedures to minimize the carbon absorption at the surface of low carbon stainless steel castings produced in mold with organic binders were investigated. The amount of carbon pickup was determined at the surface of CF3M stainless steel castings poured in step block molds with thicknesses of one to three inches, six inch cube blocks with various inserts and one inch thick valve castings produced in shell molds. The organic binders studied included alkyd-resin, shell molds with phenolic resin, furan and baked core oil. The carbon absorption was measured primarily by metallographic procedures with a few checks of carbon content at layers of 0.005 inch increments below the surface. The corrosion tests were conducted with boiling 65 weight percent nitric acid as the standard Huey test except that the cast surface was tested in both the as cast and solution condition. Dissert. Abstr.

N80-29478 Carnegie-Mellon Univ., Pittsburgh, Pa.
CONTRIBUTION TO THE PHYSICAL CHEMISTRY OF METAL-GAS AND METAL-ALUMINA INTERFACES Ph.D. Thesis
Bernard Michel Gallois 1980 318 p
Avail: Univ. Microfilms Order No. 8017452

The sessile crop method was used to investigate the energetics of metal gas and metal alumina interfaces. The surface tensions and the densities of Ag-Au-Cu alloys were determined from their liquidus temperatures to 1108 C. Surface tension minima, which are indicative of ordering phenomena found in the limiting binaries Ag-Cu and Ag-Au and in the two pseudobinary sections, investigated which correspond to atomic ratios of gold to silver equal to 0.4 and 2.5. A graphical method to determine relative adsorptions from thermochemical data and from surface tension isotherms was developed. Dissert. Abstr.

N80-29479 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE EFFECT OF DEFECTS ON THE FATIGUE CRACK INITIATION PROCESS IN TWO P/M SUPERALLOYS Ph.D. Thesis
John Michael Hyzak 1980 248 p
Avail: Univ. Microfilms Order No. 8017454

The effect of defect size, shape, and population on the fatigue initiation process in two high strength P/M superalloys, AF 115 and AF2 IDA were investigated. The specific alloy heats tested had contrasting defect populations: the AF 115 alloy contained a large population of spherical pores, and a lesser number of elliptical ceramic inclusions and plate like hafnium oxide inclusions, and the AF2 IDA material contained only a small population of the elliptically shaped inclusions. Strain

controlled fatigue tests were performed on uniform section specimens at 760 C, 649 C, and 22 C using both continuously cycling and cyclic dwell waveforms. The results indicate that at high strain ranges the track propagation phase of fatigue life was most critical and therefore, defect size and population were most important. At the lower strain ranges, the initiation phase of life was more critical in the overall fatigue process and defect shape was shown to be of primary concern. Dissert. Abstr.

N80-29480 Stanford Univ., Calif.
THE INFLUENCE OF GRAIN BOUNDARY SEGREGATION AND CAVITY FORMATION OF HIGH-TEMPERATURE FRACTURE OF SILVER AND COPPER Ph.D. Thesis
Tai-Gang Nieh 1980 134 p
Avail: Univ. Microfilms Order No. 8016855

The effects of grain boundary segregation and cavity formation on high temperature fracture of silver and copper were investigated. The thermodynamic and kinetic conditions for water vapor bubble formation in pure metals were reviewed. The technique of implanting water vapor bubbles in metals has proven to be a very useful tool for the study of intergranular cavity growth in metals at elevated temperatures. The tensile and creep properties of oxygen free and oxygen saturated polycrystalline copper were studied in the temperature range 25 C to 500 C. It is shown that oxygen increases the yield strength by a factor of 2 or 3, by solid solution hardening, and for coarse grained copper, causes a severe embrittlement, particularly under creep conditions. Both direct and indirect evidence indicates that the embrittlement is caused by the segregation of oxygen to the grain boundaries in copper, thus promoting grain boundary decohesion and intergranular fracture. Dissert. Abstr.

N80-29481 Illinois Univ. at Urbana-Champaign.
EFFECTS OF SURFACE OXIDATION ON VACANCY DEFECTS IN BETA NICKEL-ALUMINUM ALLOYS Ph.D. Thesis
Arvind Parthasarathi 1980 146 p
Avail: Univ. Microfilms Order No. 8018197

Transmission electron microscopy and Auger electron spectroscopy were used to make observations of the oxidation process in beta-NiAl alloys annealed under controlled conditions of temperature and oxygen partial pressure. Binary Ni-Al alloys, with nominally 47.5, 50.4 and 52.5 at % Al, were examined. The Auger spectroscopy analysis showed that the predominant oxide formed on these alloys is Al2O3, with a possible thin intermediate layer of spinel. Bulk oxidation experiments indicate that the oxide grows by outward diffusion of cations to the oxide/gas interface. As a result of this diffusion, a counter-flow of vacancies occures, and these vacancies are injected into the substrate. The vacancy injection results in formation and growth of existing vacancy dislocation loops and internal voids in thin foil samples. Vacancy loop growth rates increase with annealing time and also increase as the oxygen partial pressure is increased in accordance with a vacancy injection model. This vacancy injection takes place in the alloys tested here, at temperatures above about 600 C, even in ultra vacuum annealing atmospheres. An exception was found in the case of samples annealed at T > 850 C in UHV. Dissert. Abstr.

N80-29482 Pittsburgh Univ., Pa.
ANALYSIS AND MEASUREMENT OF SEGREGATION IN DIRECTIONALLY SOLIDIFIED NICKEL BASE SUPERALLOY Ph.D. Thesis
Ramasamy Sellamuthu 1980 293 p
Avail: Univ. Microfilms Order No. 8015384

Microsegregation and macrosegregation were examined in hafnium modified Mar-M200 superalloy. Microsegregation, measured by eutectic fraction was determined as a function of cooling rates. Macrosegregation, measured by eutectic fraction and local alloy content, was determined in regions of abrupt reductions in cross-section in directionally solidified cylinders. A plane from solidification technique was used to determine the partition ratio of several of the alloy elements in the nickel base superalloy. Explanations of the microsegregation and marcosegregation behavior were developed based on theories developed, originally, for less complex alloys and the fundamental data determined herein. With regard to the normal range of directional solidification conditions, it is shown that variations in the amount of eutectic are the result of macrosegregation. Dissert. Abstr.

N80-29483 Illinois Univ., Urbana-Champaign.
TRIBOLOGY AND MICRO-CHEMISTRY OF SPUTTER DEPOSITED COMPOSITE COATINGS ON HONED STEEL SUBSTRATES Ph.D Thesis
Lawrence Ching-Yu Wu 1980 151 p
Avail: Univ. Microfilms Order No. 8018219

The tribology and microchemistry of TiO2-TiC composite coatings on chemically honed steel substrates was investigated. The primary wear resistant coatings (TiC) were deposited by radio frequency sputtering using a dc substrate bias and the solid lubricant coatings (TiO2) were deposited in an Ar and O2 mixed RF glow discharge. Chemically honed steel substrates which consisted of a checkerboard of raised squares separated by 1.5 micrometers in deep channels were prepared by photolithographic and masking techniques. A pin on disc apparatus was used to measure friction and wear characteristics of composite coatings. The composite coating chemistry was analyzed by Auger electron spectroscopy (AES); in addition, AES was used to characterize the wear transfer mechanism between steel and the composite coating. Dissert. Abstr.

N80-29484 Illinois Univ., Urbana-Champaign.
A MODEL FOR JOINING THE FATIGUE CRACK INITIATION AND PROPAGATION ANALYSES Ph.D. Thesis
Wen-Ching Chen 1980 126 p
Avail: Univ. Microfilms Order No. 8017920

An analytical model for nonarbitrarily defining the crack initiation length of a notched member on basis of the minimum total life estimate (Life-calculation method) is proposed. The crack initiation length is not a fixed value, as usually assumed, but varies with stress level (or life) notch size, notch geometry, and material. The partitioning of crack initistion life and crack propagation life is achieved using this model. An interpretation of fatigue notch size effect and a powerful means for numerically determining Neuber and Peterson parameters is provided. Dissert. Abstr.

N80-29485 Carnegie-Mellon Univ., Pittsburgh, Pa.
PHASE TRANSFORMATIONS AND PROPERTIES OF Ti-10V-2Fe-3Al Ph.D. Thesis
Thomas Walter Duerig 1980 304 p
Avail: Univ. Microfilms Order No. 8017451

The phase transformations, tensile properties and fatigue propagation resistance of the relatively new metastable Beta titanium alloy (Ti10V-2Fe-3A) are reported. The alternate omega reaction, the growth of isothermal omega, the precipitation of alpha and the stress assisted martensitic transformation from Beta to alpha double prime (orthorhombic) are considered. All of these reactions are discussed both in mechanistic terms, and in terms of processing history. The tensile properties of Ti-10V-2Fe-3Al in both the aged and unaged conditions are then discussed in view of the above phase transformations. Lastly, the fatigue crack propagation rate in high strength conditions of Ti-10V-2Fe-3Al is described as a variable of microstructure and stress intensity. It is shown that the primary microstructural variables are the alloy's primary alpha content, the extent of recrystallization, the omega phase, and the fine secondary alpha. Dissert. Abstr.

N80-29486 Kentucky Univ., Lexington.
THE SINTERING OF A SILICA SUPPORTED NICKEL CATALYST Ph.D. Thesis
Hai-Ku James Kuo 1980 162 p
Avail: Univ. Microfilms Order No. 8018247

The sintering behavior of a silica supported nickel catalyst was studied by following the changes in the average particle size and particle size distribution (PSI) function. Sintering of the supported nickel catalyst was carried out in nitrogen and hydrogen atmospheres at temperatures from 500 to 800 C for times varying from 1 to 100 hrs. An X-ray single profile analysis method has been employed to measure the average particle sizes, lattice microstrains and PSD functions of the supported nickel catalyst from the Ni(200) diffraction profiles. The PSD functions determined from the X-ray single profile analysis method were compared to those determined from transmission electron microscopy and an excellent agreement was obtained. Very

good agreement was also found when the PSDs were fitted to the lognormal distribution functions. Dissert. Abstr.

N80-29487# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
STRUCTURE AND PROPERTIES OF RAPIDLY SOLIDIFIED 2000 SERIES Al-Li ALLOYS
N. J. Grant, S. Kang, and W. Wang 20 May 1980 23 p refs Presented at the Intern. Conf. on Aluminum Lithium Alloys, Stone Mountain, Ga., 19-20 May 1980
(Contract N00014-78-C-0385; ARPA Order 3558)
(AD-A085354) Avail: NTIS HC A02/MF A01 CSCL 11/6

The literature appears convincing that of the Al-Li alloys, Al-Cu-Li provides stronger alloys than does Al-Mg-Li. Yet, such earlier studies were based on ingot technology where segregation problems could conceivably have worsened actual comparisons. Further, the phase diagrams for these two ternary systems are poorly known, especially if significant additions of Mn, Cd, Cr, Ti, Zr and other elements are made. In fact the Al-Cu-Mg-Li quaternary based on the 2024 alloy gave some rather excellent combinations of strength and toughness when the alloys were made from rapidly solidified (RS) particulates. Continuing alloy development, structure refinement, and property assessments, based on RS technology, are the basis of this study. Both 2020 and 2024 base alloys are being prepared by RS powder technology (ultrasonic gas atomization with quench rates of ten to the 4th power to ten to the 5th power K/s); lithium contents from about 1 to 3 weight percent are being studied at several different ratios of Cu to Li. Phase identification studies are being planned but only preliminary data are available. Mechanical properties (smooth bar tension tests) appear excellent for the Al-Cu-Li alloys, significantly better than for the 2024 base alloy. Notch toughness tests are still a problem even though improvements are being made. GRA

N80-29488# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS FOR AEROSPACE STRUCTURAL APPLICATIONS Interim Technical Report, 5 Sep. 1979 - 4 Feb. 1980
R. E. Lewis, I. G. Palmer, D. D. Crooks, H. Paris (Aluminum Co. of America), F. Billman (Aluminum Co. of America), E. A. Starke, Jr. (Georgia Inst. of Tech.), A. Gysler (Georgia Inst. of Tech.), E. E. Underwood (Georgia Inst. of Tech.), and R. Crooks (Georgia Inst. of Tech.) Mar. 1980 86 p refs
(Contract F33615-78-C-5203; ARPA Order 3417; AF Proj. 3417)
(AD-A085651; LMSC-D686125) Avail: NTIS HC A05/MF A01 CSCL 11/6

Advanced aluminum alloys are being developed that will provide majors payoffs in terms of weight savings for new aerospace structures. The two property goals are: (1) a 30 percent increase in modulus of elasticity-to-density ratio, and (2) a 20 percent increase in modulus of elasticity-to-density ratio plus a 20 percent increase in strength-to-density ratio, when compared to Al 7075-T76 and without a significant loss in other properties important for structural applications. The program is organized into three phases: (1) a fundamental alloy and process development study; (2) scale-up of two best alloys and (3) evaluation of mill product forms. GRA

N80-29489# Wisconsin Univ. - Milwaukee. Dept. of Physics.
ELECTROMIGRATION AND THERMOMIGRATION IN METALS Final Report, 30 Jun. 1976 - 31 Dec. 1979
Richard S. Sorbello 15 Feb. 1980 8 p refs
(Grant AF-AFOSR-3082-76; AF Proj. 2306)
(AD-A085524; AFOSR-80-0401TR) Avail: NTIS HC A02/MF A01 CSCL 20/17

The object of this research was to investigate theoretically the driving force for electromigration and thermomigration in metals. The driving force for electromigration was shown to be equal to the local electric field accompanying electron transport. The force was determined from the linear response expression of Kumar and Sorbello using both the Green's function formalism and the Kohn-Luttinger formalism. Corrections to previous force expressions were derived. The effects of atomic configuration on electromigration was investigated within a pseudoatom picture. Application was made to lattice distortion, fast-diffusers, grain boundaries and isotope effects. Calculations were made of the driving force in liquid-metal alloys and were found to be in agreement with experiment. The Kohn-Luttinger formalism was applied to electromigration in an inversion layer. The driving force for thermomigration was examined. A linear-response expression was derived for the electronic component of the driving force. GRA

N80-29490# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
STRESS CORROSION RESISTANCE OF 7010-T73651 Progress Report
L. A. Biggs Washington 16 Apr. 1980 14 p refs
(ZF61542001)
(AD-A086150; NADC-80038-60) Avail: NTIS HC A02/MF A01 CSCL 11/6

A 7010-T73651 Aluminum Alloy was compared to 7050-T73651 in stress corrosion and exfoliation tests. Results of a 30 day alternate immersion test in 3 1/2 percent NaCl indicate that 7010-T73651 has a threshold stress of 35 ksi (240 MPa) and is resistant to exfoliation. The threshold stress for cracking of the 7050-T73651 was 45 ksi (310 MPa). GRA

N80-29491# Oak Ridge National Lab., Tenn. Chemical Technology Div.
IODINE ADSORPTION ON STEEL IN HELIUM
M. F. Osborne and R. B. Briggs 1979 8 p refs Presented at the ANS Winter Meeting, San Francisco, 11-16 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791103-83) Avail: NTIS HC A02/MF A01

The equilibrium loading of iodine on low chromium alloy steel as functions of iodine partial pressure, temperature, and metal surface conditions were measured. Desorption rates as functions of temperature and He purity were found and the hazards of iodine release as related to licensing and operation were studied. DOE

N80-29492# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CORROSION IN LITHIUM-STAINLESS STEEL THERMAL-CONVECTION SYSTEMS
P. F. Tortorelli, J. H. DeVan, and J. E. Selle 1980 22 p refs Presented at the 2d Intern. Conf. of Liquid Metal Technol. for Energy Systems, Richland, Wash., 20 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800401-1) Avail: NTIS HC A02/MF A01

The corrosion of types 304L and 316 austenitic stainless steel by flowing lithium was studied in thermal convection loops operated at 500 to 650 C. Both weight and compositional changes were measured on specimens distributed throughout each loop and were combined with metallographic examinations to evaluate the corrosion processes. The corrosion rate and mass transfer characteristics did not significantly differ between the two austenitic stainless steels. Addition of 500 or 1700 wt ppM N to purified lithium did not increase the dissolution rate or change the attack mode of type 316 stainless steel. Adding 5 wt % Al to the lithium reduced the weight loss of this steel by a factor of 5 relative to a pure lithium-thermal-convection loop. DOE

N80-29493# National Technical Information Service, Springfield, Va.
FERROUS METAL CASTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Apr. 1979
William E. Reed Apr. 1980 234 p
(PB80-808455) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

An updated bibliography is presented containing 161 abstracts. Major emphasis is placed on: iron and steel continuous casting; die and precision casting. R.C.T.

N80-29494# National Technical Information Service, Springfield, Va.
FERROUS METAL CASTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, May 1979 - Apr. 1980
William E. Reed Apr. 1980 167 p Supersedes NTIS/PS-79/0475; NTIS/PS-78/0288

(PB80-808462; NTIS/PS-79/0475; NTIS/PS-78/0288) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Worldwide research is cited on iron and steel continuous casting, die casting, and precision casting. Studies on molds, mold release agents, shrinkage, solidification, defects, and additives are included. This updated bibliography contains 161 abstracts, all of which are new entries to the previous edition. GRA

N80-29495# National Technical Information Service, Springfield, Va.

FERROUS METALS CASTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980

William E. Reed Apr. 1980 274 p Supersedes NTIS/PS-79/0473; NTIS/PS-78/0287

(PB80-808477; NTIS/PS-79/0473; NTIS/PS-78/0287) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Federally sponsored research includes casting processes, heat treatment, quality control, solidification, microstructure, mechanical properties, additives, and purification. Studies are included on casting and its involvement in scrap reuse, air pollution, and tool manufacture. This updated bibliography contains 266 abstracts, 23 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-29496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CASTABLE HIGH TEMPERATURE REFRACTORY MATERIALS Patent Application

I. Zaplatynsky, inventor (to NASA) Filed 30 Jul. 1980 5 p

(NASA-Case-LEW-13080-1; US-Patent-Appl-SN-173521) Avail: NTIS HC A02/MF A01 CSCL 07D

A method is disclosed for fabricating chemically inert ceramic bodies that are both highly refractory and porous. A paste is formed by mixing alumina grain having uniform particle size with colloidal silica that is stabilized with ammonia. After drying, the cast body has sufficient green strength to be handled, and it is transferred to a furnace for curing. A green body prepared in this fashion does not undergo shrinkage during curing nor during prolonged subsequent heating. NASA

N80-29497# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.

DEVELOPMENT OF HARD ELASTIC SOLIDS FROM GLASSY POLYMERS Interim Report

Abdelsamie Moet, Igor Palley, and Eric Baer 10 Jun. 1980 56 p refs

(Contract N00014-75-C-0795)

(AD-A085804; TR-10) Avail: NTIS HC A04/MF A01 CSCL 11/9

High impact polystyrene (HIPS) has been processed into a specific microstructure which exhibited the hard elastic behavior previously restricted to crystalline polymers. Unidirectionally stacked profuse crazes formed in uniaxially elongated HIPS reproduced morphologies resembling the row nucleated structures of stacked lamellar aggregates bridged by extended fibrils. Films in this form possess repeated high recovery from large extension without rapture. Stress-Strain and stress-relaxation tests performed in air and in a variety of liquids in addition to thermoelastic experiments indicate that this novel material has identical characteristics to that of hard elastic crystalline polymers. The time-independent component of elastic recovery was found to be an energy driven process which originates largely from surface forces. Our results confirm that the recovery process of elastic HIPS, like crystalline systems, is composed of an instantaneous component in addition to time-dependent healing mechanism. The first was found to be energetic in nature whereas the second remained conformational (entropic). A structural model is presented which explains the observed mechanical and structural data. The model is based on the reversible extensive formation of fresh surface of the craze (or interlamellar) fibrillar material giving rise to the elastic restorative force. Time-dependent 'healing' stems from the conformational character maintained by the subfibrils. Stress-induced sorption and release of liquid, a newly discovered property, is also discussed. GRA

N80-29498# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Nonmetallic Materials Div.

HIGH TEMPERATURE REACTIVE THERMOPLASTIC AROMATIC POLYIMIDES Final Report, Oct. 1978 - Dec. 1979

B. A. Reinhardt and F. E. Arnold Apr. 1980 37 p refs

(AF Proj. 2419)

(AD-A085596; AFWAL-TR-80-4013) Avail: NTIS HC A03/MF A01 CSCL 11/9

A series of high molecular weight aromatic enyne polyimides were prepared by the condensation of various aromatic dianhydrides with (E)-3,3'-(1-buten-3-ynylene) dianiline (I). The polymers were soluble in low boiling solvents and exhibited intrinsic viscosities as high as 0.7 with glass transition temperatures ranging from 200-265 C. The new thermoplastic materials have the capability to become lightly crosslinked when thermally treated during a stimulated high temperature thermoforming process. Thermal treatment diminishes the various solvent-induced problems inherent in linear polymeric materials, as well as advances the glass transition temperature. Copolymers were also prepared using 1,3-bis(amino-phenoxy) benzene and (I) in an effort to obtain various percentages of enyne along the polymer backbone and therefore control the degree of crosslinking. Selected copolymer compositions are currently being evaluated as thermoplastic composite materials with improved solvent resistance. GRA

N80-29499# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

MOLECULAR COMPOSITES: RODLIKE POLYMER REINFORCING AND AMORPHOUS POLYMER MATRIX Final Report, Oct. 1978 - Jun. 1979

G. Husman, T. Helminiak, M. Wellman, W. Adams, D. Wiff (Dayton Univ.), and C. Benner (Dayton Univ.) May 1980 35 p refs (AF Proj. 2303)

(AD-A086149; AFWAL-TR-80-4034) Avail: NTIS HC A03/MF A01 CSCL 11/4

The concept of molecular composites utilizing rod-like aromatic heterocyclic polymers as reinforcements in coil-like heterocyclic polymer matrices has been demonstrated. A series of polymer films, prepared by vacuum casting from various solutions of rod-like polymer, amorphous polymer, and solvent, were fabricated and tested. Morphological studies of these films were conducted using X-ray diffraction and scanning electron microscopy. The results of the morphology studies showed pronounced structure and definite evidence of the ordering of the rod-like polymer. In some cases, a second phase or conglomeration was evidenced. Analysis of the scanning electron microscopy pictures indicated that the second phase was itself a composite of rod-like and amorphous polymer. The mechanical testing showed significant increases in tensile modulus and strength with only ten percent rod-like polymer in the matrix; this was especially true after stretching of the film had been performed. Analytical equations developed for composite materials were used to calculate theoretical properties of the conglomerates and rods. All results and conclusions are presented in detail in this report. GRA

N80-29500# Erlangen-Nuremberg Univ. (West Germany). Lehrstuhl Glas und Keramik.

THERMAL DIFFUSION IN GLASS MELTS UNDER ZERO GRAVITY CONDITIONS: STUDIES UNDER ONE g Final Report

Rainer Stoephasius, Helmut A. Schaeffer, Gerhard Tomandl, Gerd Helland, and Heinrich Engelke Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1979 25 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-08) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 4,85

The effect of thermal diffusion as characterized by the Soret coefficient, was investigated in glasses and glass melts. A

cylindrical sample of a sodium-potassium-silicate glass was exposed to a radial temperature gradient of 800 K/cm for periods of from 3 to 20 days. concentration profiles of potassium, measured by electron microprobe, indicate that potassium is depleted at the hot end and enriched at the cold end. Electroneutrality requires the sodium concentration profile to the opposite that of potassium. The case of stationary thermal diffusion was not achieved. Therefore, the differential equation was solved numerically for the nonstationary case. The calculated concentration profiles can be fitted to the experimental curves satisfactorily by assuming a mean Soret coefficient of S sub K = -0.0005/K. Due to the relatively low temperatures, convective effects apparently play only a minor role. The determination of the Soret coefficients of ions of low mobility such as Rb(+), Cs(+), and alkaline Earth ions requires higher temperatures and therefore zero gravity conditions to prevent convective perturbations. Author (ESA)

N80-29501# Siemens A.G., Munich (West Germany). Geschaeftsbereich Weitverkehrssysteme.
INVESTIGATION OF CARBON FIBER REINFORCED PLASTICS FOR HIGH FREQUENCY COMPONENTS Final Report
Walter Altmann, Hans Georg Kerzl, and Ottmar Schweizer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-16) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10.30

High frequency components used in satellite subunits are usually made of metal alloys (e.g., Invar) to meet requirements with respect to thermal characteristics. The disadvantage of these materials is the relatively high specific weight. An investigation to determine whether a suitable alternative material is available for the manufacture of diplexer filters for satellite applications was conducted. When initial tests with carbon fiber reinforced plastics from Canada showed satisfactory results, products on the German market were studied to determine their suitability. Analysis of the mechanical properties and chemical characteristics of available domestic and foreign materials show that German material in its present stage of development is satisfactory for filter construction. Nonetheless, the poor reproducibility of thermal shock test results, interpreted from holographic interferometric measurements, indicates the need for further improvement of deformation properties. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-29502*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME ADVANTAGES OF METHANE IN AN AIRCRAFT GAS TURBINE
Robert W. Graham and Arthur J. Glassman 1980 18 p refs Proposed for presentation at Aerospace Congr., Los Angeles, 13-16 Oct. 1980; sponsored by ASAE
(NASA-TM-81559; E-520) Avail: NTIS HC A02/MF A01 CSCL 21D

Liquid methane, which can be manufactured from any of the hydrocarbon sources such as coal, shale biomass, and organic waste considered as a petroleum replacement for aircraft fuels. A simple cycle analysis is carried out for a turboprop engine flying a Mach 0.8 and 10, 688 meters (35,000 ft.) altitude. Cycle performance comparisions are rendered for four cases in which the turbine cooling air is cooled or not cooled by the methane fuel. The advantages and disadvantages of involving the fuel in the turbine cooling system are discussed. Methane combustion characteristics are appreciably different from Jet A and will require different combustor designs. Although a number of similar difficult technical problems exist, a highly fuel efficient turboprop engine burning methane appear to be feasible. A.R.H.

N80-29503# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1, PHASE G. SERIES B, TP-H-1011 Semiannual Report
John A. Thompson Apr. 1980 135 p refs
(AD-A085630; MANCP-438(80)) Avail: NTIS HC A07/MF A01 CSCL 21/8

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M04046C-WNL01529. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (fourteen years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system. GRA

N80-29504# Ad-Ex International, Portola Valley, Calif.
EXPERIMENTAL STUDIES OF SOME REGULARITIES IN THE UNDERGROUND GASIFICATION OF INCLINED COAL SEAMS
M. K. Revva and E. V. Kreinin Mar. 1980 19 p refs Transl. into ENGLISH from Probl. Podzemn. Gazifikatsii v Kuzbasse USSR (Kemerovol, no. 2, 1967 p 143-153 Sponsored by DOE Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11585) Avail: NTIS HC A02/MF A01

Under natural conditions, the participation of underground water in the gasification process is considerably above the optimum level, and in cola seams 1 and 2 m thick is characterized by a specific water inflow of 1500 to 2500 kg/ton, and by a moisture content of 250 to 400 g/cum in the gas. The combustion heat of the gas in coal seams 1 and 2 m thick (especially in the first case) therefore is significantly below 1000 kcal/cu m under such conditions. The decrease in the combustion heat of the gas with decreasing coal seam thickness is explained by the obvious increase in heat losses to the surrounding rock mass. An increase in the amount of underground water lowers the calorific value still further. The efficiency of gasification of coal seams 8.5, 2, and 1 m thick gradually decreases, being 65 to 70, 55 to 60, and 45 to 50%, respectively. Thus, as the thickness of the coal seam being gasified decreases, one must reduce the involvement of influent underground water in the gasification process. This can be accomplished by increasing the efficiency of the drying of the coal seam being gasified, or by intensifying the gasification process. DOE

N80-29505# General Atomic Co., San Diego, Calif.
SOLAROIL PROJECT. PHASE 1: PRELIMINARY DESIGN REPORT
G. Baccaglini, J. Bass, J. Neill, V. Nicolayeff, and F. Openshaw Mar. 1980 439 p refs
(Contract DE-AC03-79CS-30308; GA Proj. 3315)
(GA-A-15823) Avail: NTIS HC A19/MF A01

The Solar Thermal Enhance Oil Recovery (Solar Oil) Plant is designed to demonstrate that using solar thermal energy is technically feasible and economically viable in enhanced oil recovery. The plant uses the fixed mirror solar concentrator to heat high thermal capacity oil to 322 C (611 F). The hot fluid is pumped from a hot oil storage tank (20 min capacity) through a once through steam generator which produces 4.8 MPa (700 psi) steam at 80% quality. The plant net output, average over 24 hr/day for 365 day/yr, is equivalent to that of a 2.4 MW (8.33 x 10 to the 6 power Btu/hr) oil fired steam generator having a 86% availability. The net plant efficiency is 57.3% at equinox noon, a 30%/yr average. The plant will be demonstrated at an oilfield site near Oildale, California. DOE

N80-29506# Aerojet Energy Conservation Co., Sacramento, Calif.
STUDY OF GELLED LNG Final Technical Report

M. I. Rudnicki, J. A. Cabeal, L. C. Hoffman, R. A. Newton, R. K. Schaplowsky, and E. M. VanderWall Jan. 1980 150 p refs
(Contract EP-78-C-03-2057)
(DOE/EV-02057/T2) Avail: NTIS HC A07/MF A01

Research involved the characterization of gelled LNG (GELNG) with respect to process, flow, and use properties and an examination of the degree of safety enhancement attainable by gelation. The investigation included (1) an experimental examination of gel properties and gel safety characteristics as well as (2) an analytical study involving the economics and preliminary design of an industrial scale gelation system. The safety-related criterion for successful application of gelled LNG is the substantial reduction of the Maximum Distance to the Lower Flammability Limit, MDLFL. This will be achieved by first, gel-inhibition of the hydrodynamic pooling and spreading of the spill, and second, the suppressed thermal transport properties of the GELNG relative to those of LNG. The industrial scale gelation study evaluated a design capable of producing 11,000 gallons (LNG tank truck) of gel in two hours. The initial assumption that gelation would provide a practical means to enhance safety is supported by the results of this study. Larger scale, comparative spill tests of LNG and GELNG are now required to confirm the safety aspects of use of the gelled material. DOE

N80-29507# Department of Energy, Grand Forks, N. Dak. Grand Forks Energy Technology Center.
EFFECT OF OPERATING CONDITIONS ON PRODUCTION OF LIGHT HYDROCARBON GASES IN SLAGGING FIXED-BED COAL GASIFICATION
Jacquelyn K. Olson and Harold H. Schobert 1980 10 p refs
(GFETC/RI-80/2) Avail: NTIS HC A02/MF A01

Light hydrocarbon gases - methane through butane - produced during the slagging fixed bed gasification of lignites and subbituminous coals were determined by cryogenic oven gas chromatography using Chromsorb 102 columns. Changing gasification parameters to increase gas residence time, by increasing pressure or decreasing oxygen feed rate, increased the amount of these gases formed. The increased formation of the light hydrocarbons arose from breakdown of coal tars, since the additional amount of gaseous hydrocarbons corresponded well with an observed decrease in tar formation. DOE

N80-29508# Amoco Oil Co., Naperville, Ill. Research and Development Dept.
CATALYST DEVELOPMENT FOR COAL LIQUEFACTION Final Report, Feb. 1978 - Feb. 1979
D. K. Kim, R. J. Bertolacini, J. M. Forgac, R. J. Pellet, K. K. Robinson, and C. V. McDaniel (Grace (W. R.) and Co., Columbia, Md.) Nov. 1979 355 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 408-1; EPRI Proj. 408-2)
(EPRI-AF-1233) Avail: NTIS HC A16/MF A01

Catalysts were developed for liquefaction of high sulfur Eastern coal. A higher severity aging test was employed to ensure that results in the Amoco pilot plant would translate to H-coal operation. Catalyst ranking at the higher severity conditions remained unchanged. The criticality of the bimodal pore distribution was clearly demonstrated with cobalt molybdena catalysts prepared on two essentially identical aluminas but one having essentially no macropore volute. The absence of macropore volume resulted in rapid catalyst deactivation. The liquefaction catalysts were characterized on the basis of reactivity. DOE

N80-29509# SRI International Corp., Menlo Park, Calif.
SHIFT CONVERSION AND METHANATION IN COAL GASIFICATION: BENCH-SCALE EVALUATION OF A SULFUR RESISTANT CATALYST Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
B. J. Wood, D. Sheridan, J. G. McCarty, C. M. Ablow, and H. Wise 15 Apr. 1980 18 p refs
(Contract ET-78-C-01-3240; SRI Proj. PYU-7930)
(FE-3240-T5) Avail: NTIS HC A02/MF A01

The long term bench scale study previously reported a demonstrated degree of improvement in specific methanation activity, lifetime, and sulfur resistance exhibited by the over a commercial catalyst (Ni/Al2O3). However, quantitative interpretation of the results by measurements of H2S-breakthrough was obscured by the interaction of the particulate alumina diluent with the sulfur poison in the feed stream. To assess the magnitude of this perturbation by the diluent, a series of experimental measurements was performed in smaller reactors containing the catalyst samples without any diluent added to the catalyst bed. In these experiments the decline in the rates of methane production and CO conversion, and the appearance of H2S in the product stream were monitored. DOE

N80-29510# Bechtel International Corp., San Francisco, Calif.
PRODUCTION OF SYNTHETIC LIQUIDS FROM COAL, 1980 - 2000. PRELIMINARY STUDY OF POTENTIAL IMPEDIMENTS Final Report
Dec. 1979 264 p refs
(Contract ET-78-C-01-3137)
(FE-3137-T1) Avail: NTIS HC A12/MF A01

Potential impediments for the 3 million barrels per day (MMBPD) scenario were identified in the following areas: engineering manpower; manual labor, certain materials and equipment, and plant permits and licenses. Chemical engineers working in this area must be increased by one-third by 1985. Pipefitters, pipefitters-welders, boilermakers, boilermaker-welders and electricians will be in short supply. In certain regions of the country, 30 to 80 percent of the available manpower in some of these trades will be required by the 3 MMBPD coal liquids program. The availability of 34 categories of material and equipment was assessed in order to identify potential impediments. The following categories appear to be potentially critical for the 3 MMBPD program: draglines, heat exchangers, pressure vessels, centrifugal compressors, and alloy and stainless steel valves. DOE

N80-29511# Battelle Columbus Labs., Ohio.
CARBOHYDRATE CROPS AS A RENEWABLE RESOURCE FOR FUELS PRODUCTION. VOLUME 3: JUICE PRESERVATION
D. J. Fink, B. R. Allen, J. H. Litchfield, and E. S. Lipinsky 29 Jan. 1980 40 p refs
(Contract W-7405-eng-92)
(BMI-2031-Vol-3) Avail: NTIS HC A03/MF A01

Polysaccharide hydrolysis was investigated as a means for preserving mixed sugar solutions obtained from crops such as sweet sorghum. Experiments conducted were directed to achieve concentration of (1) pure sugar solutions by hydrolysis of purified starch; (2) genuine sugar crop juice by hydrolysis of purified starch; (3) pure sugar solutions by hydrolysis of genuine biomass starch; and (4) pure sugar solutions by hydrolysis of cellulosic materials. Inhibition of the cellobiase component of the cellulase preparation was observed in the experiments. Results demonstrate the feasibility of one approach to the preparation of concentrated, microbiologically stable sugar syrups starting with sweet sorghum juice. DOE

N80-29512# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
BIOMASS LIQUEFACTION EFFORTS IN THE UNITED STATES
Sabri Ergun Feb. 1980 23 p
(Contract W-7405-eng-48)
(LBL-10456) Avail: NTIS HC A02/MF A01

Research programs being conducted in the biomass liquefaction are summarized. The facilities in Albany, Oregon and at LBL are described and flowcharts are included. The reactions occuring during these processes are explained. Properties of the oil produced are described. DOE

N80-29513# Suntech, Inc., Marcus Hook, Pa. Research and Engineering Div.
RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR THE CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE FUELS Quarterly Technical Progress Report, Apr. - Jun. 1979
A. Schneider, E. J. Hollstein, E. J. Janoski, and E. G. Scheibel Oct. 1979 28 p
(Contract EX-76-C-01-2306)
(FE-2306-38; QTPR-9) Avail: NTIS HC A03/MF A01

Continuous dimethylformamide (DMF)-heptane extractions of solvent refined coal-2 (SRC-2) were conducted. The data confirm

that the extraction column can be operated at suitable conditions to remove any desired amount of coal liquids as extract product. Countercurrent operation of the 33 stage, three inch, baffled, Scheibel extraction column gives exceptionally high throughputs with the DMF-heptane system. Results indicate that: (1) the raffinate products of the 25 to 27% extractions contain 90 wt % aromatic, 0.4 wt % nitrogen, and 0.3 wt % oxygen; (2) hydrodenitrogenation of the raffinate product proceeds at a rate six times faster than nonextracted SRC-2 C to yield a product possibly suitable as a hydrocracker or fluid catalytic cracker feed; and (3) the extract products of the 25% to 27% extractions contain 8 wt % oxygen and 2.5 wt % nitrogen. GRA

N80-29514# Suntech, Inc., Marcus Hook, Pa. Research and Engineering Div.

RESEARCH AND DEVELOPMENT OF AN ADVANCED PROCESS FOR THE CONVERSION OF COAL TO SYNTHETIC GASOLINE AND OTHER DISTILLATE FUELS Quarterly Technical Progress Report, Jan. - Mar. 1979

A. Schneider, E. J. Hollstein, E. J. Janoski, and E. G. Scheibel May 1979 46 p

(Contract EX-76-C-01-2306)

(FE-2306-35; QTPR-8) Avail: NTIS HC A03/MF A01

The feasibility of continuous deep liquid extraction of coal liquids with dimethylformamide (DMF)-heptane is demonstrated. It is concluded that the use of DMF-heptane is more practical than aqueous tailored to remove any desired amount of coal liquids. The extraction procedure as practiced with either DMF or aqueous methanol does not remove all basic nitrogenous material but successfully removes the phenolic material. Attempts to hydrorefine the highly phenolic extract product causes the evolution of much methane at relatively low temperatures. Catalytic hydrodeoxygenation follow first order kinetics. DOE

N80-29515# Pennsylvania State Univ., University Park. Dept. of Chemistry.

INSTRUMENTAL ANALYSIS OF SULFUR COMPOUNDS IN COAL PROCESS STREAMS Quarterly Technical Progress Report, Apr. - Jun. 1979

Joseph Jordan Jul. 1979 27 p refs

(Contract EF-77-S-01-2710)

(FE-2710-7) Avail: NTIS HC A03/MF A01

A synopsis of progress is presented. Sulfate and thiosulfate yielded well-defined differential pulse polarograms at the dropping mercury electrodes. Differential pulse voltammetry of benzothiophene at a rotated glassy carbon disk anode yielded peak signals which were proportional to concentration in a range between 0.00004 M and 0.002 M. Injection of bisulfide samples into an excess of the reagent hydroxmercury benzoate produced temperature increments which provided a linear measure of HS concentration in a range between 50 and 5000 ppM. The feasibility of the determination of SO2 by differential pulse voltammetry at a rotated glassy carbon cathode has been demonstrated in synthane by-product waste water samples. Interfering sulfides were successfully removed by prior precipitation as CdS. Tridimensional Pourbaix Diagrams were applied to predict mole fractions of sulfur moieties in four process stream samples. The hypothetical assignments were drastically at variance with the experimentally measured ratios. DOE

N80-29516# Mitre Corp., McLean, Va.

ENVIRONMENTAL DATA ENERGY TECHNOLOGY CHARACTERISTICS: SYNTHETIC FUELS

Apr. 1980 102 p refs

(Contract EX-76-C-10-3876)

(DOE/EV-0073) Avail: NTIS HC A06/MF A01

The transformation of the energy in coal and oil shale into a more useful form is described in terms of major activity areas in the synthetic fuel cycles, that is, in terms of activities which produce either an energy product or a fuel leading to the production of an energy product in a different form. The activities discussed are coal liquefaction, coal gasification, in-situ gasification, and oil shales. These activities represent both well-documented and advanced activity areas. The former activities are characterized in terms of actual operating data with allowance for future modification where appropriate. Emissions are assumed to conform to environmental standards. The advanced activity areas examined are those like coal liquefaction and in-situ retorting of oil shale. For these areas, data from pilot or demonstration plants were used where available; otherwise, engineering studies provided the data. DOE

N80-29517# Gulf Research and Development Co., Pittsburgh, Pa.

INVESTIGATION OF MECHANISMS OF HYDROGEN TRANSFER IN COAL HYDROGENATION Quarterly Progress Report, Jan. - Mar. 1979

D. C. Cronauer, R. G. Ruberto, and D. C. Young May 1979 20 p ref

(Contracts EX-76-C-01-2305; E(49-18)-2305)

(FE-2305-33) Avail: NTIS HC A02/MF A01

The analytical approach to determine the conversion of coal and/or asphaltenes to pentane soluble product (oils) was modified to limit co-solvent effects. To simulate products obtained during the initial stage of liquefaction, hydrogen transfer experiments were done asphaltenes prepared from the low severity liquefaction of Kentucky 9/14 and Illinois No. 6 coals with SRC-2 solvent. The preparation of these asphaltenes was carried out at mild liquefaction conditions of 375 C and 400 C at space times of 5 and 12 minutes. The asphaltenes were used in making an extensive number of hydrogen transfer experiments with various solvents, temperatures and reaction times. The runs were made in the 9 ml micro-reactor which is immersed in a heated sand bath. The average heat-up time is about 2.2 to 2.5 minutes. DOE

N80-29518# California Univ., Berkeley. Lawrence Berkeley Lab.

CATALYTIC BIOMASS LIQUEFACTION

Sabri Ergun, Carlos Figueroa, Cihan Karatas, Larry Schaleger, Manu Seth, James Wrathall, and Nasser Yaghoubzadeh Feb. 1980 9 p ref Presented at the 10th Thermochem. Conversion Contractors' Meeting, Berkeley, Calif., 12-13 Feb. 1980

(Contract W-7405-eng-48)

(LBL-10667; CONF-800234-1) Avail: NTIS HC A02/MF A01

The development of pumpable, concentrated biomass slurries and a bench-scale continuous tubular reactor for liquefaction is addressed. Three tasks are specifically discussed: the preparation of biomass slurries; characterization and flow properties of concentrated slurries; and the construction of biomass liquefaction process engineering unit. DOE

N80-29519# National Technical Information Service, Springfield, Va.

HYDROGEN PRODUCTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - May 1980

Diane M. Cavagnaro May 1980 208 p Supersedes NTIS/PS-79/0541

(PB80-810476; NTIS/PS-79/0541) Avail: NTIS HC $30.00/MF $30.00 CSCL 21D

The cited reports include studies on the manufacturing of hydrogen by electrolysis, coal gasification and other techniques. They cover both experimental research and production on the industrial scale. Although most of the reports are on production methods, economic studies are also included. This updated bibliography contians 200 abstracts, 56 of which are new entiries to the previous edition. GRA

N80-29520# Office of Technology Assessment, Washington, D. C.

THE DIRECT USE OF COAL. VOLUME 2, PART A: WORKING PAPERS, APPENDICES 1-4

Nov. 1979 463 p refs

(PB80-184518; OTA-E-86A-Vol-2-Pt-A-App-1-4) Avail: NTIS HC A24/MF A01 CSCL 13B

The contents include: (1) selection topics in estimating future energy deamand and supply, (2) rethinking the scale of coal-fired electric generation: technological and institutional consideration, (3) residential and commercial uses of coal, (4) coal cleaning and desulfurization, (5) direct utilization of coal: fuel gas desulfurization, and (6) miners and operators collective bargaining in coal. GRA

N80-29521# Office of Technology Assessment, Washington, D. C.

THE DIRECT USE OF COAL. VOLUME 2, PART B: WORKING PAPERS, APPENDICES 7-9
Dec. 1979 605 p refs
(PB80-184526; OTA-E-86B-Vol-2-Pt-B-App-7-9) Avail: NTIS HC A99/MF A01 CSCL 13B

The contents include: (1) environmental considerations for increased coal utilization; (2) transport and fate of sulfur and other air pollutions; and (3) prediction and review of air pollution health effects from direct coal combustion. GRA

N80-29522# Office of Technology Assessment, Washington, D. C.
THE DIRECT USE OF COAL. VOLUME 2, PART C: WORKING PAPERS, APPENDICES 10-14
Dec. 1979 542 p refs
(PB80-184534; OTA-E-86C-Vol-2-Pt-C-App-10-14) Avail: NTIS HC A23/MF A01 CSCL 13B

The contents include: (1) effects on plants of sulfur pollutants from coal combustions; (2) coal mine health; (3) social and economic impacts of coal production in the eastern United States; (4) impacts of coal development of Western communities; and (5) public attitudes toward coal-fired power plants. GRA

N80-29523# Office of Technology Assessment, Washington, D. C.
THE DIRECT USE OF COAL. VOLUME 2, PART D: WORKING PAPERS, APPENDICES 15-17
Dec. 1979 425 p refs
(PB80-184542; OTA-E-86D-Vol-2-Pt-D-App-15-17) Avail: NTIS HC A18/MF A01 CSCL 13B

The present state of the Federal coal leasing policy is examined. Abuses and problems associated with prior leasing policies and recent congressional amendments are examined and a number of reforms are suggested. Laws applicable to air emissions from the direct use of coal are cited along with the Surface Mining Control and Reclamation Act of 1977. J.M.S.

N80-29524# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
PEAT AS A FUEL AT THE PROPOSED CENTRAL MARINE POWER COMPANY 600 MW PLANT, VOLUME 1 Final Report
William J. Jones Dec. 1979 184 p refs Sponsored in part by Central Maine Power Co.
(PB80-175185; MIT-EL-79-012-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 10B

The findings and recommendations resulting from an exploratory assessment of the technical feasibility of using peat instead of coal are presented. The economic and institutional issues that may be involved as a result of such a substitution are considered. It is intended for a broad spectrum of readers. GRA

N80-29525# Environmental Protection Agency, Ann Arbor, Mich. Technology Assessment and Evaluation Branch.
GASOHOL TEST PROGRAM
Richard Lawrence Feb. 1980 39 p
(PB80-171226; EPA-AA-TAEB-79-48) Avail: NTIS HC A03/MF A01 CSCL 21D

A request for a waiver to permit use of ten percent ethanol in gasoline (gasohol) was considered by EPA-Mobile Source Enforcement Division. Ten vehicles were tested on two gasoline fuels and three gasohol fuels and three vehicles on the five fuels plus other fuels containing methyl tertiary butyl ether and tertiary butyl alcohol, other fuel additives for which waivers were requested. More extensive emission data on two test vehicles was obtained. Since completion of the tests, EPA has acted to allow the use of ten percent ethanol in gasoline. Future control of this or other fuel additives is authorized under Section 211 of the 1977 Amendments to the Clean Air Act. GRA

N80-29526# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
PREPARATION AND STABILITY OF EMULSIONS OF METHANOL IN AUTOMOTIVE DIESEL OIL
C. G. McCormack Oct. 1979 35 p refs
(PB80-169162; CSIR-CENG-294; ISBN-0-7988-1730-5) Avail: NTIS HC A03/MF A01 CSCL 21D

Short term emulsification of up to 20% methanol in diesel oil (stability lasting a few hours) is feasible but the emulsifiers successful in this respect are costly and have to be applied in relatively high concentrations. No emulsifier was found which produces an emulsion with long term stability; mutual solubilities of the various components and solubility changes with temperature were identified as the most important causes. It is unlikely that an emulsifier will be found which produces stable temperature insensitive emulsions of methanol in diesel oil. Even if such an emulsifier exists the required amount and costs are expected to be prohibitive in a fuel application. GRA

N80-29527# New Mexico Inst. of Mining and Technology, Socorro.
COORDINATING FOSSIL FUEL RESEARCH IN NATURAL GAS RECOVERY
1979 29 p
(PB80-169469) Avail: NTIS HC A03/MF A01 CSCL 08I

Projects that range from studying the State's fossil fuel resources to developing new methods for expanded exploration, improving production techniques, and developing programs which best utilize these resources are reviewed. GRA

N80-29528# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
PREDICTING METHANE FERMENTATION BIODEGRADABILITY Final Report
J. A. Chandler and W. J. Jewell Mar. 1980 254 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-09038-1) Avail: NTIS HC A12/MF A01

Fifteen substrates, representing a wide range of cell soluble, cell wall and cell wall lignin contents, were batch fermented at 35 C for 120 days. Daily gas production was measured for the first 90 days of the fermentation period. Both initial and fermented substrate solids underwent fiber analyses to determine their exact composition and to measure extent of biodegradation achieved after 120 days. Based on batch fermentation and fiber analyses results, four models predicting substrate biodegradable fraction were constructed and evaluated. Predicting biodegradability based on volatile solids lignin content was found to be the superior model. The analyses required by this model can be completed within one day. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-29529 Oregon Univ., Eugene.
A MICROSCOPIC APPROACH TO SUPERFLUID FLOW IN HELIUM-2 Ph.D. Thesis
Zaka Ullah Khan 1980 106 p
Avail: Univ. Microfilms Order No. 8017887

The vortices in superfluid helium are considered in the context of metastability of rotational flow and also through an investigation of creation of vortices in an ideal superfluid flow. The model of an ideal Bose gas initially in rotation with respect to a cylindrical container at rest having a localized roughness on the wall is considered. The solution for the time evolution of an initial state containing one, two and three vortices each of unit circulation is obtained by solving time dependent Schrodinger equation. The convergent results obtained indicate that a vortex present initially inside the container describes a trajectory which eventually reaches the cylinder wall for all ranges of values considered for a perturbation strength parameter. Once the vortex reaches the wall it disappears continuously as the node changes into a 'dimple in the wave function' which disappears continuously as a function of time. Solution of the time dependent Gross-Pitaevski equation, shows that a vortex present initally close to the wall moves away from it slowing down almost exponentially. So in this model of the interacting Bose gas the vortex describes a trajectory that never reaches the wall and hence corresponds to a metastable state. The vortex formation due to an effect of a protuberance from the wall bounding a semi-infinite plane is also studied.
Dissert. Abstr.

N80-29530# Naval Civil Engineering Lab., Port Hueneme, Calif.
CONCRETE SANDWICH CONSTRUCTION FOR ENERGY CONSERVATION Final Report, Oct. 1975 - Sep. 1978
John R. Keeton Mar. 1980 19 p refs
(ZF5751001)
(AD-A085446; CEL-TN-1574) Avail: NTIS HC A02/MF A01 CSCL 13/13

An abbreviated research study on use of shrinkage-compensating expansive concrete in sandwich-type wall and roof panels containing insulation at mid-thickness is described. The use of expansive concrete is shown to be a technically viable concept for eliminating shrinkage cracking, thus preventing moisture penetration which can reduce insulation effectiveness, cause deterioration of the insulating material, and accelerate steel corrosion. Embeddable resistance strain gages proved to be reliable for measuring expansion and subsequent shrinkage of the experimental panels. As a result of this study, a comprehensive research program is proposed for experimental verification of design and field control measures that will permit the use of shrinkage-compensating cement mortars in sandwich panel construction. GRA

N80-29531# California Univ., Los Angeles. Dept. of Physics.
A STUDY OF PERSISTENT CURRENTS IN SUPERFLUID He-4 Ph.D. Thesis Interim Report
Roset Khosropour Talaghany Mar. 1980 121 p refs
(Contract N00014-75-C-0246; NR Proj. 384-302)
(AD-A085767; TR-40) Avail: NTIS HC A06/MF A01 CSCL 20/13

Decay of saturated persistent currents in superleaks in contact with bulk superfluid helium has been studied using Doppler shifts of the acoustic modes of an annular resonator partially packed with superleak. The two acoustic modes are an interpolated first-fourth sound and a modified second sound. Decay of such currents have been measured at 1.35 degrees K for annuli 10, 20, 40, 60, 80, 90, 95 and 100 percent filled with superleak. The main result which is somewhat surprising, is that the saturated persistent current and its fractional decay rate varies only slightly with superleak depth and the average decay rate is about 2.5% per decade. Another phenomena which was also studied is the Doppler shift of gravity waves in a partially packed powder. The velocity of gravity waves is about three orders of magnitude smaller than the fourth sound velocity in a similar geometry. Thus it seemed appropriate to use its Doppler shift for measuring small persistent currents. A theoretical study of the problem showed that the gravity waves are not Doppler shifted in the presence of a persistent current in superleak, however the waves are still Doppler shifted by the persistent currents in the free region. Experiments support the theoretical prediction, and also indicate the existence of a small current of about 8 millimeters per second in the free region. GRA

N80-29532# Naval Civil Engineering Lab., Port Hueneme, Calif.
SOLAR HEATING OF BUILDINGS AND DOMESTIC HOT WATER
Edward R. Durlak May 1980 182 p refs
(AD-A085815; CEL-TR-877) Avail: NTIS HC A09/MF A01 CSCL 13/1

This report presents design criteria and cost analysis for methods for the sizing and justification of solar heat collectors for potable water heaters and space heaters. Sufficient information is presented to enable engineers to design solar space and water heating systems or conduct basic feasibility studies preparatory to design of large installations. Both retrofit and new installations are considered. This report has been substantially revised from the previous edition Beck and Field, 1977. However, most of the revision is in Section 2.0, where more material of an exploratory nature has been added. Section 3.0, which contains the calculation method and worksheets, is largely the same, except that the economic analysis has been revised and new tables have been added to provide a self-contained source of meteorological data and collector test data. GRA

N80-29533# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
MINIMIZING MAXIMUM LATENESS IN A TWO-MACHINE OPEN SHOP
E. L. Lawler (California Univ., Berkeley), J. K. Lenstra, and A. H. G. Rinnooy-Kan (Erasmus Univ.) Sep. 1979 15 p refs Submitted for publication
(Grant NSF MCS-76-17605)
(MC-BW-112/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The problem of scheduling independent jobs in a two machine open shop so as to minimize the maximum lateness with respect to due dates for the jobs is considered. Each job consists of two operations, one of length a sub j which is to be executed on machine M sub 1 and one of length b sub j which is to be executed on machine M sub 2. There is no restriction on the order in which the operations of a job are to be performed, hence the term open shop. For the case in which preemption is allowed, a linear time algorithm is presented. For the nonpreemptive case, NP-hardness is established. Author (ESA)

N80-29534# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SIMPLIFIED ENERGY DESIGN ECONOMICS: PRINCIPLES OF ECONOMICS APPLIED TO ENERGY CONSERVATION AND SOLAR ENERGY INVESTMENTS IN BUILDINGS Final Report
Harold E. Marshall, Rosalie T. Ruegg, and Forest Wilson Jan. 1980 57 p
(PB80-179245; NBS-SP-544) Avail: NTIS HC A04/MF A01 CSCL 13A

Economic analysis techniques for evaluating alternative energy conservation investments in buildings are presented. Life cycle cost, benefit cost, savings to investment, payback, and rate of return analyses are explained and illustrated. The procedure for discounting is described for a heat pump investment. Formulas, tables of discount factors, and detailed instructions are provided to give all information required to make economic evaluations of energy conserving building designs. GRA

N80-29535# Missouri Univ. -Rolla. Dept. of Civil Engineering.
INVESTIGATION OF THE EFFECT OF 3-D PARAMETRIC EARTHQUAKE MOTIONS ON STABILITY OF ELASTIC AND INELASTIC BUILDING SYSTEMS
Franklin Y. Cheng and Prasert Kitipitayangkul Aug. 1979 397 p refs
(Grant NSF ENV-75-18372)
(PB80-176936; NSF/RA-790399; Rept-79-10; Rept-1) Avail: NTIS HC A17/MF A01 CSCL 13M

The effect of interacting, three dimensional ground motions on the response behavior of elastic and inelastic building systems is investigated. The building systems may have elevator cores, floor diaphragms, and shear walls of reinforced concrete as well as steel beams, columns, and bracings. The stiffness matrices are derived from the Ramberg-Osgood hysteresis model for steel and Takeda's model for concrete. The geometric matrix is formulated for the second-order effect on large deflections. The interacting forces on the yielding surfaces of the members are included. A computer program, INRESB-3D, has been comprehensively developed for achieving efficiency in both computation and data preparation. A total of 26 numerical examples were studied for various low-rise and high-rise building systems, which show that an interacting ground motion can significantly increase internal forces, nodal displacements, ductilities, and seismic input and dissipated energy. The large ductilities and the excessive permanent deformations induced by a coupling motion exhibit severe local damage and thus diminish the serviceability of a structure. GRA

N80-29536# Missouri Univ. -Rolla. Dept. of Civil Engineering.
INRESB-3D: A COMPUTER PROGRAM FOR INELASTIC ANALYSIS OF REINFORCED CONCRETE STEEL BUILDINGS SUBJECTED TO 3-DIMENSIONAL GROUND MOTIONS
Franklin Y. Cheng and Prasert Kitipitayangkul Aug. 1979 105 p
(Grant NSF ENV-75-18372)
(PB80-176944; NSF/RA-790400; Rept-2; Rept-79-11) Avail: NTIS HC A06/MF A01 CSCL 13M

A user's guide is presented for the computer program, INRESB-3D, for analyzing elastic and inelastic building systems subjected to the simultaneous input of static loads and multicom-

ponent earthquake motions, which can be applied in any direction of the structural plane. The building systems may have elevated cores, floor diaphragms, and shear walls of reinforced concrete, as well as beams, columns, and bracings. The computer program was developed to achieve efficiency in both computation and data preparation. The output solutions include the static results of member forces and nodal displacements, as well as the dynamic results of member forces, nodal displacements, ductility factors, excursion ratios, seismic input energies, dissipated energies, and the options of plotting some of the dynamic results. GRA

N80-29537# Swedish Council for Building Research, Stockholm.
REPORTING FORMAT FOR THERMAL PERFORMANCE OF SOLAR HEATING AND COOLING SYSTEMS IN BUILDINGS
Per Isakson (Royal Inst. of Tech.), William Kennish (TPI, Inc.), and Egil Ofverholm (Royal Inst. of Tech.) Feb. 1980 60 p refs
(PB80-175375; D1-1980; ISBN-91-540-3157-5) Avail: NTIS HC A04/MF A01 CSCL 13A

The performance of solar testing and cooling systems and the cost effectiveness of these systems is considered. Common procedures for predicting, measuring, and reporting the thermal performance of systems and methods for designing economical, optimized systems are discussed. GRA

N80-29538# National Bureau of Standards, Washington, D.C.
REPORT OF THE 64TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES
Harold F. Wollin, ed., Louis E. Babeoq, ed., and Ann P. Heffernan, ed. Mar. 1980 316 p refs Conf. held at Portland, Oreg., 23-27 Jul. 1979
(PB80-175128; NBS-SP-566; LC-26-27766) Avail: NTIS HC A14/MF A01 CSCL 14B

Major issues discussed at this conference include metric conversion in the United States, particularly the conversion of gasoline dispensers, problems relating to the quantity fill of packaged commodities especially as affected by moisture loss and statistical approach to package checking. Federal grain inspection, and a legal metrology control system are also discussed. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-29539* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COLLAPSIBLE CORRUGATED HORN ANTENNA Patent
Donald E. Barthlome, inventor (to NASA) Issued 9 May 1978 6 p Filed 20 May 1977 Supersedes N77-24339 (15 - 15, p 1976) Sponsored by NASA
(NASA-Case-LAR-11745-1; US-Patent-4,089,004; US-Patent-Appl-SN-799025; US-Patent-Class-343-786) Avail: US Patent and Trademark Office CSCL 09C

A horn antenna that is readily collapsible while not in use is described. A number of different sized annular metal rings are arranged in a sequence such that each ring is larger than the one that precedes it in the sequence. A number of thin flexible electrically conductive members attach successive metal rings together physically and connect them together electrically. Each flexible conductive member is attached to make electrical contact between the outside surface of a metal ring and the inside surface of an adjacent metal ring in the sequence.
Official Gazette of the U.S. Patent and Trademark Office

N80-29540 Rice Univ., Houston, Tex.
OPTIMAL ESTIMATION FOR BANDLIMITED SIGNALS Ph.D. Thesis
Dean Paul Kolba 1979 123 p
Avail: Univ. Microfilms Order No. 8018062

The desired estimate is based on a finite number of time samples taken from a measurement interval of length TM. With no additional information, the estimate is based on these samples alone. When the signal is bandlimited with normalized bandwidth beta, this provides additional information which is used to improve the estimate by extrapolating the signal. The effectiveness of this extrapolation is limited to an interval of length TL is approximately TM/2 beta. Various bandlimited estimation methods surveyed do not make explicit use of the effective extrapolation limit TL. An estimation method for bandlimited signals is described which does incorporate the interval TL into the problem formulation. Estimation with inexact data is considered. Sensitivity of the bandlimited estimation methods to errors in the data is discussed. Estimation with smoothing is utilized in reducing the effects of this noise. A recursive algorithm for the calculation of the new estimation method is described. The estimates are computed using discrete prolate spheroidal sequences. A FORTRAN program implementing the new handlimited estimation method is presented. Dissert. Abstr.

N80-29541 Maryland Univ., College Park.
APPLICATIONS OF PICOSECOND PHOTOCONDUCTIVITY IN SEMICONDUCTORS Ph.D. Thesis
Paul Sze-Ngai Mak 1979 192 p
Avail: Univ. Microfilms Order No. 8016979

The propagation of millimeter waves at 94 GHz in silicon waveguides was optically controlled by photo induced carriers in the waveguide. Phase shifts as high as 300 deg/cm of millimeter waves were observed accompanied by less than 1 dB insertion loss. Optoelectronic switching and gating in silicon waveguides were achieved. Picosecond photoconductivity switching in CdS(0.5)Se(0.5) was investigated using a standard pulse line charger configuration. Electric impulse of variable duration ranging from one to a few nanoseconds were produced by illuminating the semiconductor sample with a single green laser pulse. The photoconductive lifetime of the charge carriers was also measured. An optical detector that can measure picosecond pulsewidth of a light pulse was constructed of seven pieces of CdS(0.5)Se(0.5) crystals which exhibited two photon conductivity effect when illuminated by 1.06 micron optical radiation. The measured correlation curve yielded a pulsewidth of 10 picoseconds with a contrast ratio of 28:1. Dissert. Abstr.

N80-29542 British Broadcasting Corp., Kingswood (England). Engineering Div.
THE USE OF THE 26 MHz BAND FOR SATELLITE BROADCASTING
G. J. Phillips and P. Knight Jul. 1980 12 p refs
(BBC-RD-1980/5) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The existing top hf band (25.6 -- 26.1 MHz) might be more effectively used than at present for international broadcasting if transmissions from satellites were permitted. Although the World Administrative Radio Conference, Geneva, 1979 did not extend the use of the band in this way, a useful record is given of the technical studies made in the preparation for the Conference. Propagation factors which would limit such a service are examined, and it is found that signals from a geostationary satellite could reach a large area around the subsatellite point (up to ± 50 deg relative longitude and latitude) for a high percentage of time, day and night. Curves are presented also for two cases of a sub-synchronous satellite. Estimates for the RF transmitter power required vary from 1 to 5 kW depending on the orbit and whether narrow band frequency modulation is used in place of conventional amplitude modulation. Author

N80-29543*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
COMPLEMENTARY CROSS-SLOT PHASED ARRAY ANTENNA Patent Application
Haynes Ellis, Jr., inventor (to NASA) (Rockwell International Corp., Downey, Calif.) Filed 25 Jul. 1980 14 p Sponsored by NASA
(NASA-Case-MSC-18532-1; US-Patent-Appl-SN-172099) Avail: NTIS HC A02/MF A01 CSCL 09C

A flush mounting, cavity-backed, dual orthogonal slot antenna is described in which improved radiation pattern characteristics are obtained by making the spiral slot pattern elliptical in the

aperture plane. Coaxial split-tube baluns are used to drive the junctions between corresponding slot pairs. Optional cavity dielectric is provided and a drive coupling arrangement includes a four port compartor hybrid having sum and difference ports respectively, for alternate excitation to produce a single lobe or a double lobe pattern with null. Switching appratus is provided to connect a common terminal to either of the ports. NASA

N80-29544*# Texas Instruments, Inc., Dallas. Equipment Group.
REPORT FOR SIMULTANEOUS, MULTIPLE INDEPENDENTLY STEERED BEAM STUDY FOR AIRBORNE ELECTRONICALLY STEERABLE PHASED ARRAY (AESPA) PROGRAM Final Report
May 1978 129 p
(Contract NAS8-32627)
(NASA-CR-161394; EM-911-05-78) Avail: NTIS HC A07/MF A01 CSCL 20N

Design concepts of an array for the formation of multiple, simultaneous, independently pointed beams for satellite communication links were investigated through tradeoffs of various approaches which were conceived as possible solutions to the problem. After the preferred approach was selected, a more detailed design was configured and is presented as a candidate system that should be given further consideration for development leading to a preliminary design. This array uses an attenuator and a phase shifter with every element. The aperture excitation necessary to form the four beams is calculated and then placed across the array using these devices. Pattern analysis was performed for two beam and four beam cases with numerous patterns being presented. Parameter evaluation shown includes pointing accuracy and beam shape, sidelobe characteristics, gain control, and beam normalization. It was demonstrated that a 4 bit phase shifter and a 6 bit, 30 dB attenuator were sufficient to achieve adequate pattern performances. The phase amplitude steered multibeam array offers the flexibility of 1 to 4 beams with an increase in gain of 6 dB if only one beam is selected. R.K.G.

N80-29545# Indian Space Research Organization, Bangalore.
TOTAL ELECTRON CONTENT DATA COLLECTED DURING ATS-6 RADIO BEACON EXPERIMENTS IN INDIA, AUGUST 1975 TO JULY 1976
Dec. 1978 88 p
(ISRO-SN-07-78) Avail: NTIS HC A05/MF A01

Total electron count data from ATS 6 beacon transmission are presented in tabular form. The data sheets include the following: satellite used; frequencies used; technique employed; geographic latitude and longitude of the subionospheric point at the mean field height; elevation angle at the observing station; conversion factor use; and mean field height. Guidelines for data sheet format are included. E.D.K.

N80-29546*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Electrical Hybrid Vehicle System.
AN ASSESSMENT OF INDUCTIVE COUPLING ROADWAY POWERED VEHICLES
K. O. Leschly, A. Feinberg, R. Heft, and G. Warren 15 Aug. 1980 263 p refs
(Contracts NAS7-100; EM-78-I-01-4209)
(NASA-CR-163437; JPL-Pub-79-115) Avail: NTIS HC A12/MF A01 CSCL 17B

The technical concept underlying the roadway powered vehicle system is the combination of an electrical power source embedded in the roadway and a vehicle-mounted power pickup that is inductively coupled to the roadway power source. The feasibility of such a system, implemented on a large scale was investigated. Factors considered included current and potential transportation modes and requirements, economics, energy, technology, social and institutional issues. These factors interrelate in highly complex ways, and a firm understanding of each of them does not yet exist. The study therefore was structured to manipulate known data in equally complex ways to produce a schema of options and useful questions that can form a basis for further, harder research. A dialectical inquiry technique was used in which two adversary teams, mediated by a third-party team, debated each factor and its interrelationship with the whole of the known information on the topic. Author

N80-29547# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DEICING A SATELLITE COMMUNICATION ANTENNA: SPECIAL REPORT
Ben Hanamoto, John J. Gagnon, and Blanchard Pratt Apr. 1980 17 p
(AD-A085397; CRREL-SR-80-18) Avail: NTIS HC A02/MF A01 CSCL 22/12

Ice buildup on communication antenna dishes begins to cause signal reception problems when the thickness exceeds 0.64 cm (0.25 in.). CRREL's copolymer coating, which reduces the adhesive force between ice and the coated surface, was tested on antenna dish panels to facilitate ice removal. A combination of the copolymer coating and heat proved to be an effective method of removing ice from the panel. GRA

N80-29548# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SATNET DEVELOPMENT AND OPERATION PLURIBUS SATELLITE IMP DEVELOPMENT REMOTE SITE MAINTENANCE INTERNET DEVELOPMENT MOBILE ACCESS TERMINAL NETWORK Progress Report, 1 Feb. - 30 Apr. 1980
R. D. Bressler May 1980 45 p
(Contracts MDA903-76-C-0252; N00039-78-C-0405; N00039-79-C-0386; MDA903-80-C-0353; DAHC15-69-C-0179; F08606-73-C-0027; F08606-75-C-0032; MDA903-76-C-0213; ARPA Order 3214; ARPA Order 3151)
(AD-A085807; BBN-4399) Avail: NTIS HC A03/MF A01 CSCL 17/2

This quarterly technical report describes work on the development of and experimentation with packet broadcast by satellite; on development of Pluribus Satellite IMP; on a study of the technology of Remote Site Maintenance; on the development of Internetwork monitoring; and on shipboard satellite communications. GRA

N80-29549# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF ADAPTIVE ANTENNA ARRAYS ON BROADBAND SIGNALS M.S. Thesis
William Artman Riski Jun. 1980 164 p refs
(AD-A085708; AFIT/GE/EE/80-4) Avail: NTIS HC A08/MF A01 CSCL 09/5

This paper develops a complex baseband model for an adaptive array with N isotropic elements and T tapped delay lines behind each element. Three aspects of arrays are represented: spatial and temporal propagation delays and the weighting coefficients. The model is used to determine the steady state effect of arrays on wideband signals. Optimum weights are calculated based on the noise covariance matrix produced by single and multiple narrowband jammers and single broadband jammers. It is shown that discrete spectral lines can be used to model a broadband jammer. For a jammer with 4% f0 bandwidth, this approximation yields a correlation function which is accurate to within 0.53%. For a linear, equally spaced adaptive array the output consists of the input signal and its first time derivative. This first derivative distortion is reduced by the addition of tapped delay lines only when the noise environment contains broadband jammers. This performance improvement is quantified by increased null depth. The improvement, for a 4% f0 bandwidth jammer, was 6.2 db with a jammer located at 10 degrees and 2.5 db for a jammer at 50 degrees. GRA

N80-29550# Rome Air Development Center, Griffiss AFB, N.Y.
ANTENNA TECHNOLOGY FOR SPACE BASED RADAR. PART 1: SUBARRAYING FEEDS BANDWIDTH, LOW SIDELOBE PERFORMANCE AND SUBARRAY NULLING
Robert J. Mailloux Feb. 1980 19 p refs
(AF Proj. 4600)
(AD-A085568; RADC-TR-79-358) Avail: NTIS HC A02/MF A01 CSCL 17/9

This brief analysis outlines the features of a subarraying system with amplitude control circuits at the feed array face. The analysis treats the idealization of the lens feed as a continuous aperture, and includes the assumption that the cylindrical lens back face is in the far field of the array feed. The analysis includes the effect of truncation at the main array, and demonstrates that the high sidelobes of the conventional sin

x/x subarray illumination, when truncated, are primary contributors to high grating lobe levels under certain circumstances. The proposed correction for these truncation effects is to produce a low sidelobe subarray illumination at the main aperture by controlling the feed array taper. Numerical results show the effectiveness of this subarraying technique for controlling the array far sidelobes and grating lobe levels, and for producing wide band null troughs within the subarray pattern. GRA

N80-29551# Rome Air Development Center, Griffiss AFB, N.Y.
DETECTION OF RADAR SIGNAL MODULATIONS INDUCED BY TARGET AIRCRAFT STRUCTURAL VIBRATIONS
John F. Lennon Sep. 1979 59 p refs
(AF Proj. 2305)
(AD-A085570; RADC-TR-79-247) Avail: NTIS HC A04/MF A01 CSCL 17/9

The possibility of aircraft identification using radar signal modulations induced by target airframe vibrations is analyzed. Emphasis is placed on detectability of the signal modulation, but attention is given to dependence on the angle of incidence since a major concern is identification at angles where engine effects are not observable. The approach is to compare the strength of the backscatter modulation relative to the unmodulated signal from the aircraft. Since it is the modulation of the signal that is significant, and not the exact radar cross section, a simple wire model representation of the aircraft is used. The radar backscatter results at 7 MHz and 28 MHz are calculated using a modified method-of-moments solution. The method employs successive static electromagnetic scattering solutions from a target where the position of the wing has been changed between calculations. The results are considered as discrete samples of the continuous, modulated signal. The power of the modulation is then estimated by determining the relative power spectra of the modulated signal. An approach that explicitly derives continuous time dependent scatter is included. This uses a simple crossed dipole theory with wing dipole oscillations. The dipole model, however, requires external information on the location of the appropriate scattering centers along the dipoles. Since this is incident angle dependent, the model becomes cumbersome. GRA

N80-29552# SRI International Corp., Menlo Park, Calif.
BINARY ERROR RATES FOR A TWO-COMPONENT SCINTILLATION CHANNEL Progress Report, 1 Jan. - 31 Aug. 1979
Steven C. Johnson and Charles L. Rino 31 Aug. 1979 51 p refs
(Contract DNA001-77-C-0038)
(AD-A085579; AD-E300786; DNA-5071T) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes a procedure for calculating the bit error rates for binary transmission through a two-component multiplicative channel of the type that has been proposed to represent the transionospheric channel. This procedure is then used to calculate the probability of error for several cases of interest that are not represented by commonly used Gaussian models. The non-Rician/ Raleigh channel primarily affects the phase of the signal. Thus, the major impact is on coherent systems in a fast-fading environment. In all cases, however, the effects of non- Rician and non- Gaussian fading are small when compared with a Rician or Gaussian channel with comparable fading levels. GRA

N80-29553# JAYCOR, Del Mar, Calif.
ASPECTS OF LATE-TIME STRIATION BEHAVIOR AND SATELLITE COMMUNICATION EFFECTS Final Report, 22 Dec. 1976 - 31 Jan. 1979
S. Robert Goldman and Jacob L. Sperling 1 Feb. 1979 121 p
(Contract DNA001-76-C-0186)
(AD-A085577; AD-E300793; J78-2005-TR; DNA-4923) HC A06/MF A01 CSCL 17/2

This report is a study of aspects of plasma wave turbulence relevant to late-time striation behavior and satellite communication effects. These include: (1) basic theory of particle diffusion due to quasi-neutral plasma modes; (2) forms for the diffusion coefficients of linear and nonlinear mode properties; (3) relevance to E x B gradient-drift modes in the absence of other modes; (4) diffusion due to drift-dissipative turbulence; (5) characterization of the diffusion coefficient from drift-dissipative modes in computer simulations; (6) observational aspects of drift-dissipative waves relevant to in-situ measurement and scintillation; (7) discussion of some selected experimental situations and phenomena such as the BUARO release, STRESS, and three meter backscatter; and (8) survey of additional density-gradient instabilities possibly relevant to anomalous diffusion under HANE conditions. The study suggests that modes other than the E x B mode can contribute to striation dynamics at high altitudes. Possible experimental tests of the relationship of plasma turbulence and striation evolution are described. GRA

N80-29554# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
ANALYSIS OF ANTENNA RADOMES BY RAY TECHNIQUES. PART 1: POINT SOURCE Final Report
S. W. Lee, V. Jamnejad, M. S. Sheshadri, and R. Mittra May 1980 81 p refs
(Contract N00019-79-C-0281)
(AD-A085329; UIEM-80-2; UILU-ENG-80-2542) Avail: NTIS HC A05/MF A01 CSCL 17/9

A new method for attacking the radome problem is presented in this report. It improves the standard radome analyses in the two aspects: the description of the incident field, and the curvature of the radome surface as explained below. The radome is normally situated in the near-field zone of the antenna, which may be a horn, a slot, or an array. Taking into consideration the finite antenna size, we approximately replace it by an array of discrete point sources, each of which radiates a spherical wave. This approximation is different from that used in conventional techniques in which the incident field from the antenna is approximately represented by a spectrum of plane waves, instead of spherical waves. In calculating the wave transmission through the radome, the curvature of the radome is invariably ignored in conventional analyses. Our approach, however, does treat the radome as a curved surface by calculating the transmission of a spherical wave via ray techniques. In this part of the report, only the point source situated inside the radome is studied. Extensive numerical results show that the curvature of the radome may significantly modify the field transmitted through the radome. This modification cannot be accounted for by conventional radome analysis. GRA

N80-29555# Naval Oceanographic Office, Bay St. Louis, Miss.
ATLANTIC AND MEDITERRANEAN TABLES OF COMMUNICATION STATION AZIMUTHS AND LORAN-C STATION AZIMUTHS AND DISTANCES
Nov. 1979 427 p Supersedes NOO-SP-272
(AD-A085307; NOO-SP-272-1; NOO-SP-272) Avail: NTIS HC A19/MF A01 CSCL 17/3

The tables in SP-272-1 are designed for users of the Navy Communications Stations and Loran-C Stations. The tables give azimuths to communication and Loran-C stations, and distances to Loran-C stations. Index diagrams of coverage of the various tables are provided. GRA

N80-29556# SRI International Corp., Menlo Park, Calif.
TROTT COMPUTER PROGRAM FOR TWO-DIMENSIONAL STRESS WAVE PROPAGATION, VOLUME 3 Final Report, Sep. 1977 - Aug. 1978
L. Seaman and D. R. Curran Aberdeen Proving Ground, Md. ARRADCOM Apr. 1980 150 p refs
(Contract DAAK11-77-C-0083)
(AD-A085766; AD-E430455; ARBRL-CR-00428) Avail: NTIS HC A07/MF A01 CSCL 20/11

TROTT is a Lagrangian finite-difference computer program for calculating two dimensional stress wave propagation through solid, porous, and composite materials. The stress waves may be caused by impact, detonation of an explosive, or a prescribed velocity. The calculational procedure is the standard leapfrog method of von Neumann and Richtmyer, using artificial viscosity to smooth shock fronts. Quadrilateral or triangular cells are used. The momentum relations are derived by treating the cells as finite elements. Axisymmetric or planar flow can be handled. The constitutive relations include the standard Mie-Gruneisen equation-of-state and elastic-plastic, work-hardening deviator stress relations. A polytropic gas and detonating flow relations are provided for explosives. Ductile and brittle fracture and

shear banding are provided by nucleation and growth models. Porous materials can be represented by a cap plasticity model. A model for layered composites is also present. The code is constructed for easy insertion of additional material models. The number of extra variables required for each cell for a material model can be specified on an input card. This manual includes many sample problems, a derivation of the flow equations, and a discussion of material models. GRA

N80-29557# Naval Ocean Systems Center, San Diego, Calif.
IONOSPHERIC PROFILES FOR PREDICTING NIGHTTIME VLF/LF PROPAGATION. DETERMINATION OF AN EFFECTIVE (EXPONENTIAL) MODEL FOR USE IN DESIGN AND DEPLOYMENT OF RESOURCES FOR COMMUNICATION AND NAVIGATION Final Report, Jan. 1974 - Sep. 1979
J. A. Ferguson 25 Feb. 1980 81 p refs Prepared for Defense Communications Agency, Washington, D.C. and Coast Guard, Washington, D.C.
(AD-A085399; NOSC/TR-530) Avail: NTIS HC A05/MF A01 CSCL 20/14

The regression analysis of ionospheric profiles from the literature fails to show the high ionospheric variability that is observed in the propagation measurements. Neither does it show the rapid transition in altitude between high and middle latitudes. The measured propagation data are more directly related to the MEECN and Omega system requirements for predicting vlf and lf field strengths. Profiles are suggested on the basis of the analysis of these data. GRA

N80-29558# Sperry Research Center, Sudbury, Mass.
SPACE-TIME INTEGRAL EQUATION APPROACH TO DIELECTRIC TARGETS Final Technical Report, 1 Jan. - 30 Sep. 1979
C. L. Bennett, H. Mieras, and R. Lyons Griffiss AFB, N.Y. RADC Mar. 1980 73 p refs
(Contract F30602-79-C-0060; AF Proj. 4506)
(AD-A085743; SRC-CR-79-81; RADC-TR-79-356) Avail: NTIS HC A05/MF A01 CSCL 20/3

This report describes the extension of the space-time integral equation approach to scattering from dielectric solids. The theory of the space-time integral equation approach is presented and verified by comparison with the classical solution for scattering from a sphere. The technique and solution for scattering from a complex target consisting of wings on a fuselage are presented based on a model closely resembling a Tomahawk missile. Experimental verification of the calculations is provided by time domain scattering range response measurements on a variety of targets. GRA

N80-29559# TRW Defense and Space Systems Group, Redondo Beach, Calif.
HIGH FREQUENCY MODEM FOR ADVANCED NARROWBAND DIGITAL VOICE TERMINAL Final Report
M. Adler Mar. 1980 17 p
(Contract N00014-77-C-0580)
(AD-A085984; TRW-32191) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes the software developed for the HF MODEM for the ANDVT contract. The transmitter and the receiver are described. GRA

N80-29560# Sperry Gyroscope Co., Great Neck, N. Y. Sperry Div.
RADAR RESOURCES ALLOCATION STUDY Interim Report, 1 Oct. 1978 - 30 Sep. 1979
F. J. Scire and W. R. Hanley Jan. 1980 159 p
(Contract F19628-78-C-0228; AF Proj. 4600)
(AD-A086121; SG-4253-1143; RADC-TR-79-339) Avail: NTIS HC A08/MF A01 CSCL 17/9

This interim report defines an advanced technology phased array baseline radar with potential for automatically allocating its resources according to a preselected set of algorithms. Performance data of the radar, operating in a minimally adverse environment, has been generated both mathematically and from the simulation runs of integrated radar, clutter and target math models. GRA

N80-29561# Pacific-Sierra Research Corp., Santa Monica, Calif.
ELF PROPAGATION IN THE PRESENCE OF NONSTRATIFIED IONOSPHERIC DISTURBANCES Final Report, May 1979 - Feb. 1980
E. C. Field, Jr., S. J. Gayer, and B. P. Dambrosio Jun. 1980 50 p refs
(Contract N00014-79-C-0452)
(AD-A086129; PSR-1013) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report analyzes the propagation of the TEM-ELF waveguide mode when the ionosphere is not stratified. It treats strong localized ionospheric disturbances by recasting the lateral wave equation as a two dimensional integral equation, and applies a specially developed algorithm to obtain numerical solutions. The quasi-full wave results show that a localized ionospheric disturbance behaves like a converging cylindrical lens filling a narrow aperture. Lateral diffraction and focusing, ignored in treatments that do not fully account for transverse ionospheric structure, cause the ELF signal to exhibit a pattern of maxima and minima on the line normal to the path passing through the center of the disturbance. As expected, the focusing/diffraction effects diminish when the transverse dimension of the disturbance exceeds the width of the first Fresnel zone - typically, several megameters. The analysis models widespread inhomogeneities, such as within the polar cap or at the day/night terminator, as semiinfinite regions separated by diffuse boundaries; it then derives full-wave analytic expressions for the reflection of the TEM mode. Mode reflection is found to significantly affect an ELF signal in two actual situations: first, when receivers are on great circle paths that are nearly tangential to the disturbed polar cap - in which case shadow zones and interference patterns can occur; and second, when signals are incident on the day/night terminator (from the day side) at angles exceeding about 75 deg - in which case the signals are affected by a phenomenon analogous to total internal reflection. Reflection is found to be unimportant if the boundary thickness exceeds about one-sixth of a wavelength. GRA

N80-29562# Ohio State Univ., Columbus. ElectroScience Lab.
A HYBRID MOMENT METHOD: GTD TECHNIQUE FOR ANALYSIS OF ANTENNAS MOUNTED ON OR NEAR CURVED SURFACES
Lee W. Henderson and Gary A. Thiele Apr. 1980 68 p refs
(Contract N00014-78-C-0049)
(AD-A086074; ESL-710816-7) Avail: NTIS HC A04/MF A01 CSCL 09/5

A hybrid technique which will analyze thin wire scatterers in the presence of a large conducting body is presented. This technique is quite general and applicable to a large class of problems. Two specific cases were chosen to demonstrate the usefulness of this approach. The first example given is of two piecewise sinusoidal dipoles arbitrarily positioned near an infinite, perfectly conducting cylinder. The second example provides a method for analyzing antennas mounted on the cylinder, such as a monopole. This solution is obtained as a perturbation of image theory. GRA

N80-29563# Airborne Instruments Lab., Deer Park, N. Y.
ANALYSES FOR MULTISTATIC GEOMETRIC IMAGE Final Technical Report, 18 Apr. - 19 Oct. 1979
J. S. Prichard, R. A. Baker, and W. J. Capiti Feb. 1980 71 p
(Contract F30602-79-C-0137; AF Proj. 2305)
(AD-A085866; E034-1; RADC-TR-80-18) Avail: NTIS HC A04/MF A01 CSCL 17/9

Polar format storage of two dimensional monostatic synthetic aperture radar (SAR) data (gathered in the stretch-spotlight mode of operation) allows matched two dimensional Fourier transform processing; it eliminates range walk, allowing maximum size field of view for a given resolution or finest resolution for a given size field of view. In a bistatic SAR system, iso-range and iso-Doppler contours are orthogonal only for zero bistatic angle. The range gradient diminishes as the bistatic angle is increased. When polar format storage is used, these effects result in increasing smearing (defocusing) and geometric distortion of the imagery as the bistatic angle is increased. Hence, such formatting is not matched to two dimensional transform processing. A solution to the bistatic SAR image processing problem is provided by a

new technique called coherent unskewing and reconstitution logic (Curl). The matched processing performance of the Curl technique is demonstrated using computer simulation of received data from a bistatic SAR system with two dimensional geometry. The resulting imagery is sharply focused and is totally free of geometric distortion. GRA

N80-29564# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EFFICIENT ENCODING AND DECODING OF SPEECH Quarterly Progress Report, 1 Feb. - 30 Apr. 1980
M. Berouti, M. Krasner, and J. Makhoul May 1980 39 p refs
(Contract MDA904-79-C-0411)
(AD-A085972; BBN-4384; QPR-2) Avail: NTIS HC A03/MF A01 CSCL 09/4

We report on continued research to improve the APC algorithm. The issue of system stability as a function of the linear prediction filter is discussed and a method for improving performance presented. The issue of computational complexity is also addressed. A new filter that reduces the computational load of the algorithm is designed for use in the resampling operations. GRA

N80-29565# Arinc Research Corp., Annapolis, Md.
FAA COMMUNICATIONS COST MODEL PROGRAM DOCUMENTATION: REVISED
W. Kolb, R. Tanke, and I. Gershkoff Apr. 1980 88 p
(Contract DOT-FA77WA-4018)
(AD-A086020; Rept-1339-01-702174-Rev; FAA-ASP-80-7) Avail: NTIS HC A05/MF A01 CSCL 17/2

The FAA Communications Cost Model is a computer program designed to answer management questions dealing with long-term, national-level communications planning issues. Therefore, the program is purposely directed toward estimating long-term macro-level (as opposed to near-term, micro-level) communications costs. The algorithms used emphasize cause-and-effect relationships (rather than direct extrapolation of cost data) to predict costs. This report documents the communications model computer program. It includes a description of model equations, functional flow charts, and the program listings. It should be used in conjunction with the revised FAA Communications Model User's Guide for a comprehensive understanding of the computer software. The edition supersedes the issue dated May 1979. GRA

N80-29566# New Mexico State Univ., Las Cruces. Physical Science Lab.
ON THE ANALYTICAL INVERSION OF LIDAR RETURNS FROM AN INHOMOGENEOUS ATMOSPHERE
James D. Klett White Sands Missile Range, N. Mex. Army Electron. Res. and Develop. Command Apr. 1980 51 p refs
(Contract DAAD07-79-C-0008; DA Proj. 1L1-62111-AH-71)
(AD-A085922; ERADCOM/ASL-CR-80-0008-3) Avail: NTIS HC A04/MF A01 CSCL 17/8

A new analytical method is presented for extracting attenuation and backscatter coefficients in an inhomogeneous atmosphere from the return signal of a monostatic, single wavelength lidar system. The inversion method can be applied using only information contained in the signal itself and, in sharp contrast to a well known related analytical inversion method, it is relatively tolerant of various characteristic errors and uncertainties. Inversion examples for a variety of conditions are presented and discussed. GRA

N80-29567# Naval Research Lab., Washington, D. C. Target Character Branch.
AN ANALYTICAL STUDY OF RADAR RETURNS IN THE PRESENCE OF A ROUGH SEA SURFACE Interim Report
H. R. Raemer 12 Mar. 1980 96 p refs
(SF1214191)
(AD-A086157; AD-E000437; NRL-8369) Avail: NTIS HC A05/MF A01 CSCL 17/9

The analytical study described in this report was originally undertaken in an attempt at a theoretical explanation of certain experimental results on radar return from ship targets corrupted by sea return. The analysis, like a number of previous treatments of this problem, is based on the classical perturbation approach credited to S. O. Rice. It assumes small fluctuations ('capillary waves') superposed on a large-scale 'sea swell'. Certain cross-correlation functions of the radar return are calculated. The radar-target system geometry is modeled, allowing for consideration of various antenna beam patterns, pulse shapes, sea-swell geometries and discrete targets on or near the sea surface. Terms beyond first order (second and third) are included in order to explain cross-polarization effects, which have been observed experimentally. Limited results on fourth-order terms are also obtained. However, when the analysis is carried only to fourth order and these terms are averaged, they do not contribute to the cross-polarization and their effect is seen only if specular returns are present. GRA

N80-29568# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF THE AVIATION WEATHER AND NOTAM SYSTEM (AWANS) Final Report, Aug. 1975 - Sep. 1976
Hugh D. Milligan and Bruce L. Rosenberg Jun. 1979 51 p
(AD-A086167; FAA-NA-79-13; FAA-RD-79-46) Avail: NTIS HC A04/MF A01 CSCL 17/2

This activity was conducted to ascertain the operational effectiveness of an experimental system in providing automation capabilities geared to flight service station application. Primary consideration was given to the man-machine relationship and the efficacy of the data and presentation formats made available to the specialist through the system. Maintenance, technical, and software aspects were not specifically addressed. Results of the study indicate that the automated system provides textual and graphic data in a form suitable for use in preflight and in-flight briefing modes. Further, the equipment configurations under study contained one which was acceptable, though not deemed optimal, by the specialists. This acceptability included the display size, character size and font, graphic and textual products, communications equipment, console design, and associated equipment layout. GRA

N80-29569# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A PHASE CORRECTION SYSTEM TO IMPROVE THE QUALITY OF A WIDEBAND CHIRP SIGNAL
Buchanan Loesch 5 Feb. 1980 24 p
(Contract F19628-80-C-0002; AF Proj. 649L)
(AD-A086050; TN-1980-8; ESD-TR-79-303) Avail: NTIS HC A02/MF A01 CSCL 17/4

A phase correction circuit which significantly improves the linearity of a wideband (hundreds of MHz) chirp signal has been constructed and tested. This correction circuit is applicable to a chirp generator in which a digital system is used to compute the phase of the chirp signal once each clock cycle, and the chirp signal bandwidth is then restricted to appreciably less than the clock frequency; analog frequency multiplication is then used to obtain the required bandwidth. The circuit described here corrects the high frequency phase errors which are present after the multiplication process. GRA

N80-29570# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
CIRCULARLY POLARIZED MEASUREMENTS OF RADAR BACKSCATTER FROM TERRAIN Contract Report, Aug. 1978 - Aug. 1979
E. A. Wilson, D. R. Brunfeldt, Fawwaz T. Ulaby, and J. C. Holtzman Feb. 1980 235 p refs
(Contract DAAK70-78-C-0121)
(AD-A086002; CRINC/RSL-TR-393-1; ETL-0201) Avail: NTIS HC A11/MF A01 CSCL 17/9

This report documents the design changes to the University of Kansas MAS 8-18/35 scatterometer system required to incorporate a circular polarization capability and a subsequent backscatter measurement program. The modifications enable the MAS 8-18/35 system to acquire both linear (HH, HV, VV) and circular (RR, RL, LL) radar backscatter data over its entire operating range of 8-18 GHz and 35 GHz. The measurement program described herein consisted of measurements of the backscatter coefficient, as a function of the angle of incidence (0-80) at selected frequencies in the 8-18 GHz range using circular polarization. Targets studied included coniferous and deciduous trees, wet and dry asphalt and concrete and bare and plowed ground at various moisture conditions. Coniferous and decidu-

ous tree measurements were taken in both August and November so that seasonal changes could be observed. GRA

N80-29571# Illinois Univ. at Urbana-Champaign. Urbana. Coordinated Science Lab.
QUANTIZATION EFFECTS ON DIGITAL MTI M.S. Thesis
Yu-Hong Kwong Jan. 1980 65 p refs Sponsored in part by AF
(Contract DAAG29-78-C-0016; N00014-79-C-0424)
(AD-A085886; R-868; UILU-ENG-80-2201) Avail: NTIS HC A04/MF A01 CSCL 17/9

The processing of digital signals is rapidly approaching a dominant role in both communication and radar systems. However, the physical origin of many information-bearing signals is intrinsically analog and continuous-time in nature. Therefore, an effective interface between the analog and digital worlds is of significant importance in modern signal-processing. Very often the quality of analog-to-digital (A/D) conversion is the critical limiting factor in over-all system performance. GRA

N80-29572# AEG-Telefunken, Heilbronn (West Germany). Serienprodukte A.G.
SMALL SIGNAL AND NOISE MODELING OF UHF DEVICES Final Report
Michael Ohler Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-65; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 16

Methods for the measurement and computer simulation of small signal and noise parameters in the frequency range from 100 to 1300 MHz were developed. Bipolar p-n-p transistors in the common base configuration in 'JEDEC TO 50' casings were primarily investigated. By the application of the correlation matrix method it was possible to analyze the noise behavior of complex equivalent circuits. The computer programs used make it possible to deal with computational and application problems. However, the noise parameters of transistors with high resistivity collector regions cannot be accurately determined by indirect methods since the collector charging time could not be measured with sufficient accuracy. Author (ESA)

N80-29573# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
RADAR TECHNICAL TERMINOLOGY
E. Hanle May 1979 55 p In GERMAN; ENGLISH summary
(FFM-269a) Avail: NTIS HC A04/MF A01

A glossary of radar related terms is presented. The format consists of the German term, its definition, and its English translation. The glossary is intended as a standardized reference text. Author (ESA)

N80-29574# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
ON INTEGRATING DATA PROCESSING IN SYSTEMS OF NETTED SENSORS
G. vanKeuk Nov. 1978 29 p In GERMAN; ENGLISH summary
(FFM-280) Avail: NTIS HC A03/MF A01

The scope and inherent problems of target data processing when sensor networks are involved are considered. The study is restricted to radar, sonar, and surface acoustic sensors. A distinction is made between the electronic signal processing of sensor output and the task of integrating the digital output of a variable system of distributed sensors. Both cases are discussed in terms of network software and examples of network analysis are given. Author (ESA)

N80-29575# National Technical Information Service, Springfield, Va.
INFORMATION AND COMMUNICATION THEORY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Brian Carrigan Apr. 1980 195 p Supersedes NTIS/PS-79/0441; NTIS/PS-78/0387
(PB80-807860; NTIS/PS-79/0441; NTIS/PS-78/0387) Avail: NTIS HC $30.00/MF $30.00 CSCL 09D

This bibliography cites Government sponsored research information and communication theory, including coding, decoding, and transmission of signals. Individual studies are cited on radio, television, and digital communication systems. Pure theory is also included. This updated bibliography contains 187 abstracts, 78 of which are new entries to the previous edition. GRA

N80-29576# National Technical Information Service, Springfield, Va.
BEAM LEAD MICROELECTRONICS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
William E. Reed Apr. 1980 157 p Supersedes NTIS/PS-79/0390; NTIS/PS-78/0369
(PB80-808355; NTIS/PS-79/0390; NTIS/PS-78/0369) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

Research reports from worldwide literature are cited which treat with the technology and applications of beam lead devices. Topics include chip interconnections, design, fabrication, bonding, packaging, and testing. This updated bibliography contains 151 abstracts, 16 of which are new entries to the previous edition. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-29577 Ohio Univ., Athens.
ANALYSIS OF FIRST AND SECOND ORDER BINARY QUANTIZED DIGITAL PHASE-LOCKED LOOPS FOR IDEAL AND WHITE GAUSSIAN NOISE
Paul Raymond Blasche 1980 126 p
Avail: Univ. Microfilms Order No. 8016637

Specific configurations of first and second order all digital phase locked loops were analyzed for both ideal and additive white Gaussian noise inputs. A design for a hardware digital phase locked loop capable of either first or second order operation was examined along with appropriate data obtained from testing of the hardware loop. All parameters chosen for the analysis and the design of the digital phase locked loop were consistent with an application to an Omega navigation receiver although neither the analysis nor the design were limited to this application. Ideal inputs were considered for both first and second order digital phase locked loops with the objective of classifying the time response of the loops. For both loops it was found that the phase error response was given by a nonlinear difference equation for which no direct solution was found. Partial response characteristics of the phase error were determined for both the first and second order loops when the frequency of the input signal is identical to that of the loop's quiescent frequency.
Dissert. Abstr.

N80-29578 Stanford Univ., Calif.
DIELECTRIC ISOLATION TECHNOLOGY FOR BIPOLAR AND MOS INTEGRATED CIRCUITS Ph.D. Thesis
Phillip William Barth 1980 235 p
Avail: Univ. Microfilms Order No. 8016808

Dielectric isolation technology based on preferential chemical etching techniques resulted in device quality silicon layers as thin as one micrometer. Layers were fabricated by use of a doping dependent etch (hydrofluoric, nitric, and acetic acids in a ratio of 1:3:8, concentrated reagents) which removed the bulk of a thick, heavily doped starting wafer, and stopped at a doping level of one times ten to the eighteenth atoms per cubic centimeter, leaving a lightly doped thin layer of single crystal silicon. This layer was supported by a thick substrate of deposited polycrystalline silicon, with an intervening insulator, for fabrication of dielectrically isolated integrated circuits. The dielectrically isolated silicon layers were comparable to bulk silicon wafers in terms of mobility, carrier lifetime, fixed surface charge density,

and fast surface state density. The good quality of these layers permitted the fabrication of both bipolar and MOS (metal oxide semiconductor) integrated circuits. Dissert. Abstr.

N80-29579 Michigan Univ., Ann Arbor.
SENSITIVITIES OF BIPOLAR JUNCTION TRANSISTOR ELECTRICAL PARAMETERS TO PROCESSING VARIABLES Ph.D. Thesis
Hassan Saeed Abdulkarim 1980 213 p
Avail: Univ. Microfilms Order No. 8017208

Variations and sensitivities of bipolar junction transistor (BJT) electrical parameters to processing variables were examined. The functional dependence of these sensitivities on the processing schedule employed was estimated. Some design criteria or guidelines that should be followed to reduce the sensitivities of electrical parameters and to minimize yield loss were determined. The BJT parameters considered were electrical parameters of the Ebers-Moll and hybrid-pi models, as well as some device parameters that were useful for the characterization of processing results. The processing variables considered were time and temperature for each of the processing steps of the double diffusion method, physical constants that influence the impurity distribution in silicon, and device dimensions. In evaluating the impurity atom distribution, the diffusion coefficient was assumed to be independent of impurity concentration and the superposition model was assumed for the interaction of the two oppositely charged impurities. In evaluating the electrical parameters, use of a one dimensional model and the modified Moll-Ross relations were assumed to be adequate in relating variations in electrical characteristics to variations in processing variables and physical properties. Dissert. Abstr.

N80-29580 Michigan Univ., Ann Arbor.
DIGITAL SIMULATION OF PERMANENT-MAGNET MOTORS USING FINITE ELEMENT ANALYSIS Ph.D. Thesis
Samir Qasim Fakhru 1980 240 p
Avail: Univ. Microfilms Order No. 8017257

The determination of magnetostatic fields in permanent-magnet motors is investigated. Variational finite-element formulation as well as sparse matrix procedures are used to perform an accurate magnetic field mapping of this type of motor. Results are used to obtain torque and force components acting on the rotor of the permanent magnet motor. Variational formulations of the two dimensional magnetostatic problem are performed utilizing both vector-potential and scalar-potential approaches. Boundary conditions were taken into account. Simulation studies indicate that the scalar-potential approach performs the solution task with greater accuracy than the vector-potential approach. The effect of sparse matrix procedures on the solution cost is also emphasized. Dissert. Abstr.

N80-29581 Stanford Univ., Calif.
MODELING AND CHARACTERIZATION OF SHORT-CHANNEL DOUBLE-DIFFUSED MOS TRANSISTORS Ph.D. Thesis
Donald Charles DAvanzo 1980 216 p
Avail: Univ. Microfilms Order No. 8016816

The performance of short-channel double-diffused MOS transistors was examined through extensive modeling and characterization of DMOS and VMOS transistors. Two dimensional numerical simulations reveal several second-order effects which influence short-channel device performance. The effects include a shortening of the effective electrical channel length due to the nonuniform channel profile and horizontal electric fields and significant depletion and inversion of channel charge by large horizontal fields resulting in lower threshold voltages and higher output conductances. These effects are incorporated into an analytical model based on a two transistor equivalent circuit. The key feature of the model is the use of an exponential profile approximation and a geometrical partitioning of channel charge which allow the incorporation of nonuniform profile and two dimensional field effects. The analytical model is used to simulate DMOS and VMOS enhancement-depletion inverters and to compare their performance to conventional NMOS inverters. The results imply that the double-diffused technologies are superior to conventional NMOS for masked channel lengths greater than 3.0 microns. For shorter channel lengths, velocity saturation dominates the drain characteristics so that maximum driving currents and propagation delays converge for all three technologies. Dissert. Abstr.

N80-29582 Rice Univ., Houston, Tex.
ADAPTIVE NONLINEAR IMAGE RESTORATION BY A MODIFIED KALMAN FILTERING APPROACH Ph.D. Thesis
Sarah Ann Rajala 1980 108 p
Avail: Univ. Microfilms Order No. 8018062

An adaptive nonlinear Kalman-type filter is presented for the restoration of two dimensional images degraded by general image formation system degradations and additive white noise. A vector difference equation model is used to model the degradation process. The object plane distribution function is partitioned into disjoint regions based on the amount of spatial activity in the image, and difference equation models are used to characterize the object plan distribution function. It is shown that each of the regions can be uniquely characterized by their second order statistics. The autocorrelation function for each region is then used to determine the coefficients of the difference equation model for each region. Recursive estimation techniques are applied to a composite difference equation model. Dissert. Abstr.

N80-29583*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ACTIVE NOTCH FILTER NETWORK WITH VARIABLE NOTCH DEPTH, WIDTH AND FREQUENCY Patent Application
James M. Black, inventor (to NASA) Filed 25 Jul. 1980 13 p
(NASA-Case-FRC-11055-1; US-Patent-Appl-SN-172098) Avail: NTIS HC A02/MF A01 CSCL 09A

An active notch filter having independently adjustable notch frequency, width, and depth is provided by three equal capacitors connected in series with an operational amplifier (connected in a voltage follower configuration), a potentiometer across the series connected capacitors for notch depth adjustment, and a potentiometer (for notch frequency connected across the center capacitor); with its tap connected to receive a voltage feedback signal from a variable voltage divider comprised of another potentiometer for notch width. Adjusting the voltage dividing potentiometer will independently set the notch width, and adjusting the tap on the potentiometer across the center capacitor will independently adjust the notch frequency of the filter. A second operational amplifier connected in a voltage follower configuration may be used to connect the voltage divider output to the adjustable tap of the potentiometer across the center capacitor. NASA

N80-29584*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SUPERCONDUCTING GYROCON FOR HIGH POWER HIGH EFFICIENCY MICROWAVE GENERATOR/AMPLIFIER APPLICATION Patent Application
Huan-Chun Yen, inventor (to NASA) (JPL) Filed 18 Jul. 1980 17 p
(Contract NAS7-100)
(NASA-Case-NPO-14975-1; US-Patent-Appl-SN-171927) Avail: NTIS HC A02/MF A01 CSCL 09A

The superconducting gyrocon includes an electron gun, a deflection cavity, means for coupling RF energy into the deflection cavity, an output cavity, and an output coupler for removing energy from the output cavity. The inner surface of the deflection cavity and the inner surface of the output cavity or resonator is formed of a superconducting material such as Nb3Sn, lead, or niobium. The two cavities are submerged in liquid helium in order to maintain the superconducting material at a temperature of approximately 4 degrees Kelvin. Characteristics of the thus cooled superconducting material minimizes RF losses within the gyrocon, and allows the power gain of a conventional gyrocon to be increased from approximately 13 db to 54 db, and its efficiency from 82 percent to 92 percent. NASA

N80-29585# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
A REVIEW OF THE SCIENCE AND TECHNOLOGY OF CATHODES FROM THE VIEWPOINT OF SPACECRAFT TWT APPLICATIONS Interim Report
Gary W. Stupian 1 Jun. 1980 77 p refs

(Contract F04701-79-C-0080)
(AD-A085778; TR-0080(5970-03)-2; SD-TR-80-37) Avail: NTIS HC A05/MF A01 CSCL 09/1

The current state-of-the-art of cathode science and technology is summarized, with emphasis on the types of cathode now used, or with potential use, in U.S. Air Force communication satellites. The intent is that this report be a stand-alone discussion of cathode construction and of the basic physics of electron emission. Emphasis is placed on thermionic cathodes; however, one nonthermionic emitter, the field emitter, is discussed briefly. For the thermionic emitters, the barium (calcium and strontium) oxide cathode and dispenser cathodes (based on barium) are discussed, along with variant types of the oxide and dispenser cathodes. Thorium-based cathodes and lanthanum hexaboride cathodes are also described. Some of the available data on cathode failure modes and cathode lifetime are included. Electron emission from solids has been studied with varying intensity since the last century, and the present discussion, because of the scope of the subject, of course is incomplete. Extensive literature references are given. GRA

N80-29586# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
DESIGN AND ANALYSIS OF NMOS OPERATIONAL AMPLIFIER WITH DEPLETION LOADS M.S. Thesis
Richard Dean Davis Aug. 1979 55 p refs
(Contract N00014-79-C-0424; Grant NSF ENG-78-11758)
(AD-A085313; R-857; UILU-ENG-78-2250) Avail: NTIS HC A04/MF A01 CSCL 09/5

The MOS transistor has become the building block for LSI digital circuits in recent years. Its small device size and high fabrication yield have made it particularly attractive. Recently, however, the application of MOS technology to analog circuits has been studied. One particularly useful analog circuit is the operational amplifier. The ability to fabricate an all MOS operational amplifier on an LSI chip can increase the flexibility of many signal processing tasks, such as filtering, D/A and A/D conversion. In addition, the amplifier would be compatible with other MOS circuit elements. In this thesis a single channel NMOS operational amplifier with depletion loads is designed. Computer simulation using the SPICE circuit analysis program is used as a design aid and to evaluate the final design, as this lends itself easily to the study of parameter variations within the circuit. Of particular interest is the method of internal frequency compensation of the amplifier leading to design criteria for several small signal parameters. These small signal parameters are directly related to device geometry and DC bias conditions. Other characteristics and performance criteria of the amplifier are also discussed. GRA

N80-29587# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
A FULLY MACROSCOPIC DESCRIPTION OF BOUNDED SEMICONDUCTORS WITH AN APPLICATION TO THE Si-SiO2 INTERFACE
M. G. Ancona and H. F. Tiersten May 1980 52 p refs
(Contract N00014-76-C-0368; NR Proj. 318-009)
(AD-A085674; TR-31) Avail: NTIS HC A04/MF A01 CSCL 20/12

A fully macroscopic description of semiconductors is presented which includes the boundary conditions at the surface of the semiconductor that are required for consistency with the usual diffusion-drift current equations. As in all field theories, e.g., electromagnetism, both the boundary conditions and the differential equations are obtained from the same governing integral forms. The new boundary conditions relate the jump discontinuities in the chemical potentials across the interface to the forces exerted by the lattice on the charge carries which prevent the carriers form leaving the solid. The expressions for the forces in the static case are found and the values of the material surface coefficients appearing therein are obtained from quasistatic MOS C-V measurements for some particular Si-SiO2 interfaces. GRA

N80-29588# Aerospace Corp., El Segundo, Calif.
MICROWAVE SQUID A/D CONVERTERS Interim Report
Arnold H. Silver, John P. Hurrell, Yeong-Du Song, and David C. Pridmore-Brown 5 Jun. 1980 36 p
(Contract F04701-79-C-0080)
(AD-A085897; TR-0080(5732)-1; SD-TR-80-34) Avail: NTIS HC A03/MF A01 CSCL 09/3

This document reports progress on the demonstration of an analog-to-digital converter using Josephson junction SQUID circuits. The projected performance envisions an aperture time limit of 0.25 (x 10 times 10 to the minus 12) sec with the Pb alloy junction technology. The status of junction fabrication and circuit simulations are reported. GRA

N80-29589# Illinois Univ. at Urbana-Champaign. Applied Computation Theory Group.
THE CUBE-CONNECTED-CYCLES: A VERSATILE NETWORK FOR PARALLEL COMPUTATION
Franco P. Preparata and Jean Vuillemin Nov. 1979 31 p refs Prepared in cooperation with Paris-Sud Univ., Orsay (France)
(Contracts N00014-79-C-0424; DAAG29-78-C-0016; Grant NSF MCS-78-13642)
(AD-A085846; ACT-20; UILU-ENG-80-2206) Avail: NTIS HC A03/MF A01 CSCL 09/5

We introduce an interconnection pattern of processing elements, the cube-connected-cycles (CCC), which can be used as a general purpose parallel processor. Because its design complies with present technological constraints, the CCC can also be used in the layout of many specialized large scale integrated circuits (VLSI). By combining the principles of parallelism and pipelining, the CCC can emulate the cube-connected machine and the perfect shuffle with no significant degradation of performance but with a more compact structure. We describe in detail how to program the CCC for efficiently solving a large class of problems, which includes Fast-Fourier-Transform, sorting, permutations, and derived algorithms. GRA

N80-29590# Honeywell, Inc., Hopkins, Minn. Defense Systems Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR THE 10 kHZ TAPE-AUTOMATED BONDED HYBRID MICROCIRCUIT OSCILLATOR Final Report
Bernard E. Goblish Dec. 1979 112 p
(Contract DAAG39-78-C-0010)
(AD-A085973; HDL-CR-79-010-1; HONEYWELL-2730-41637) Avail: NTIS HC A06/MF A01 CSCL 19/1

A Manufacturing Methods and Technology (MM & T) program was conducted on a 10 kHz hybrid microcircuit oscillator for use in electronic time fuzes. The oscillator which was originally developed under contract DAAG39-77-C-0056, uses tape-automated bonding (TAB) techniques to eliminate the use of individually bonded wires. The processes and achievable production rates were investigated and a total of approximately 2000 circuits were built. Recommendations are made for the equipment to be used for volume production of the oscillator. GRA

N80-29591*# Franklin Research Center, Philadelphia, Pa. Power Information Center.
SUMMARY OF THE PROCEEDINGS OF THE SUPERCONDUCTIVITY TECHNICAL EXCHANGE MEETING
16 Apr. 1980 165 p Conf. held at Washington, D.C., 16 Apr. 1980
(Contract NASw-3219)
(AD-A085974; PIC-ELE-SC209/1) Avail: NTIS HC A08/MF A01 CSCL 20/3

Contents: Large Superconductive Magnets; Superconductivity Activities at LASL; Superconductivity Studies at Argonne National Laboratory; CFFF MHD Magnet at Argonne National Laboratory; MHD Superconducting Magnets; Fermilab's Energy Saver; LCP and 12 Tesla Programs at ORNL; Division of Electric Energy System's Superconductivity Program; Development of Standards for Practical Superconductors; Casting of Dendritic Cu-Nb Alloys for Superconducting Wire; Review of Recent Developments of Multifilamentary Nb3Sn by 'in Situ' and Cold Powder Metallurgy Processes; Superconducting Magnet Facility at NRL; Airborne Superconductor Applications; High Pressure Synthesis Program at Benet Weapons Laboratory Watervliet Arsenal; CuCl; Stability and Exciton Population Percursive to Anomalous

Diagmagnetism; Navy Superconductive Machinery Development Program; and Superconducting Materials Program at NRL. GRA

N80-29592# Raytheon Co., Quincy, Mass. Industrial Components Operation.

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES FOR HIGH DENSITY THICK FILM CIRCUITS USED IN CRYSTAL OSCILLATORS, VOLUME 1 Final Report, 6 Aug. 1976 - Aug. 1979

R. Michel Zilberstein Apr. 1980 210 p refs

(Contract DAAB07-76-C-8119)

(AD-A086022; DELET-TR-76-8119F-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 09/5

Production techniques have been established for a thick film hybrid Microelectronic 17-22 MHz, temperature compensated, voltage controlled quartz crystal oscillator. The program requirements, the plans for meeting those requirements, the technical approach pursued and the technical work accomplished are described. The program was subdivided into an engineering phase and a production phase. The engineering phase consisted of the following steps: the breadboard analysis of the TCVCXO electrical design; the configuration design of the TCVCXO module; the detailed layout design of the hybrid microcircuity used in the TCVCXO module; the detailed design of piece parts to be used to seal the hybrid microcircuits and to encapsulate the modules; the establishment of process flow plans to produce the modules; and the selection, characterization, and procurement of component parts and materials required for the production of the TCVCXO modules. The production phase involved the development of tooling and manufacturing techniques needed to achieve the program requirements; and the delivery of completed modules in accordance with the program schedule. GRA

N80-29593# RCA Corp., Princeton, N. J. Microwave Technology Center.

DUAL-GATE MESFET VARIABLE-GAIN CONSTANT-OUTPUT POWER AMPLIFIER Final Report, 18 Sep. 1978 - 17 Mar. 1980

Mahesh Kumar Apr. 1980 78 p refs

(Contract N00173-78-C-0227)

(AD-A085830; PRRL-80-CR-12) Avail: NTIS HC A05/MF A01 CSCL 09/5

Phase 1 of this study proved the feasibility of the variable-gain, constant-output power amplifier from the chosen approach by demonstrating a breadboard model. During phase 2, the development of the final packaged amplifier with improved performance, the following tasks were completed: (1) a dual-gate FET amplifier was redesigned to obtain more gain (10 dB) over the band; (2) a video amplifier was designed and developed for higher gain (40 dB); and (3) circulators were eliminated to reduce the size of the amplifier. This amplifier was demonstrated to operate over a 3 GHz band (4.5 to 7.5 GHz) and to provide an output power of 3 + or - 2 dBm over its entire dynamic range of -45 to 0 dBm of input power. The linear ACG amplifier developed under this program has the following key features. (1) It preserves amplitude modulation of the incoming signal. (2) It can perform normal AGC function under a multiple-pulse condition. This characteristic may prove to be very useful for handling multiple threats. (3) It is very versatile. It can provide separate ports to facilitate output power level adjustment and input signal detection and monitoring. (4) It has very fast response. The rise time and fall time of this amplifier are better than 15 ns which is limited by the measurement systems. GRA

N80-29594# Siemens-Allis, Inc., Portland, Oreg.

ICE-RELEASE COATING FOR DISCONNECT SWITCHES Final Report

J. L. Mundon Mar. 1980 42 p Sponsored by Electric Power Research Inst.

(EPRI-EL-1330) Avail: NTIS HC A03/MF A01

Several coatings for ice release, heat dissipation, thermal cycling, and outdoor weathering properties were evaluated. The coating having the most desired performance were applied to full scale switch components. The full scale switches were tested for ice performance and heat dissipation and the results were compared with those on identical switches with uncoated components. The coating chosen for application to switch components was installed on several switches for field evaluation during the winter of 1979 and 1980. It was offered for commercial application for installation to existing switch installations. Results indicate that the coating also exhibits excellent heat dissipation properties and may be used to improve heat dissipation of switch blades and other components. The coating material is unaffected by sunlight; it is a two component, Teflon-filled polyurethane that is available from two sources. The material is currently used for a variety of purposes, such as: aircraft wing and leading edge areas, hydrofoils, conveyor chutes and many others. Light gray in color, it is an excellent heat dissipator and matches the gray insulators used with most switches. DOE

N80-29595# Texas Univ. at Austin. Center for Electromechanics.

DETAILED DESIGN, FABRICATION AND TESTING OF AN ENGINEERING PROTOTYPE COMPENSATED PULSED ALTERNATOR Final Report

W. L. Bird, Jr. and Herbert H. Woodson Mar. 1980 211 p refs

(Contract W-7405-eng-48)

(UCRL-15213) Avail: NTIS HC A10/MF A01

The design, fabrication, and test results of a prototype compensated pulsed alternator are discussed. The prototype compulsator is a vertical shaft single phase alternator with a rotating armature and salient pole stator. The machine is designed for low rep rate pulsed duty and is sized to drive a modified 10 cm Beta amplifier. The load consists of sixteen 15 mm x 20 mm x 112 cm long xenon flashlamps connected in parallel. The prototype compulsator generates an open circuit voltage of 6 kV, 180 Hz, at a maximum design speed of 5400 rpm. At maximum speed, the inertial energy stored in the compulsator rotor is 3.4 megajoules. DOE

N80-29596# National Physical Lab., Teddington (England). Div. of Computer Science.

ELECTRONIC COMPUTERS AND TELEPHONE EXCHANGES

T. H. Flowers Jan. 1980 20 p

(NPL-DNACS-24/80) Avail: NTIS HC A02/MF A01

A retrospective on the telephone, with emphasis on development of digital methods, is presented. Starting with its invention in 1876, major breakthroughs in transmission and switching circuitry are reviewed. The thermionic valve (1917), the Eccles-Jordan trigger circuit (1921), copper oxide rectifiers (1920's), and the gas-tube binary counter (1931) are highlighted. The evolution of logic design in telephone exchanges and the interaction this had with electronic computers is then traced up to the appearance of COLOSSUS, a specialized electronic computer used for cryptanalysis (1943). Author (ESA)

N80-29597# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.

DEVELOPMENT OF AN ELECTROMAGNETIC PELLET-ACCELERATOR

E. Igenbergs, H. Kuczera, and P. Lell Mar. 1979 50 p refs

(Contract F-E-10-284)

(TUM-RT-TB-79/1) Avail: NTIS HC A03/MF A01

A simple electromagnetic accelerator was developed and tested. The primary and secondary circuits (the driver) were investigated analytically and experimentally. Optimum values and configuration for the primary and secondary coils were derived in a model. Experiments were conducted to verify these values. A qualitative agreement is obtained, but the experiments reveal that some disregarded mechanisms in the model lead to lower velocities or higher diameters of the driver. Many photographs were taken of the accelerated drivers and projectiles. Different methods for the measurement of the velocity were applied and tested. A special Doppler-radar method was used. This method is shown suitable for the continuous measurement of the velocity of projectiles in the 1 mm diameter range and having velocities up to 1 km/sec. It is suggested that this electromagnetic accelerator could be used as an injector for deuterium pellets. Author (ESA)

N80-29598# Siemens A.G., Munich (West Germany). Research Lab.

LARGE SCALE INTEGRATED MOS CIRCUITS WITH NARROW STRUCTURES: INVESTIGATION OF SEMICONDUCTOR EFFECTS Final Report

Hartmut Borotka Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-67; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 8,85

Laboratory work was undertaken in order to attain better reverse current quality in MOS devices. Results show that attention must be paid to the condition of the back side of the slices where impurities may be gettered. The proper preparation of the back side gives carrier life times of 300 microsec which are reproducible. The subthreshold current behavior starts to be substantially influenced by the gate length if the gate length is shorter than a certain value, e.g., approximately 3 microns for 4 ohms cm substrate material. After implanting boron for threshold voltage adjustment and annealing at 500 C the reverse current is enhanced by more than one order of magnitude. Varying the annealing temperature a minimum for the reverse current is found after annealing at 800 C, while the original values of implanted samples are roughly reached. A generally applicable mathematical procedure was also developed allowing the prediction of the behavior of a given device structure. Results show that the surface generation current decreases monotonically with decreasing gate length. Author (ESA)

N80-29599# Technische Hochschule, Aachen (West Germany). Inst. of Semiconductor Electronics.

AUTOMATED HIGH RESOLUTION ELECTRON BEAM LITHOGRAPHY: BASIC INVESTIGATIONS ON PHYSICS AND ALIGNMENT OF SEMICONDUCTOR MICROSTRUCTURES Final Report

Hermann-Josef Geefen, Dieter Laers, Bodo Meusemann, and Dieter Stephani Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-69; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14,30

A computer controlled lithographic method for the etching of microcircuits onto a silicon wafer was studied and optimized. The direct exposure electron beam microfabricator adopted, as well as the modifications which were made in hardware and software in order to fulfill the requirements of direct material removal and alignment for multilevel devices are described. In addition, the automatic alignment algorithm, the development of appropriate reference marks, the behavior of different types of resists, and calculations according to the Monte Carlo model of backscattered electrons and their influence on process precision are presented. Author (ESA)

N80-29600# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany). Roehren- und Halbleiterwerke.

MEASUREMENT TECHNIQUES FOR INTEGRATED HIGH FREQUENCY CIRCUITS Final Report

Peter Draheim Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 98 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-75) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,60

In an approach to submicron geometries, measurement methods for capacitors of capacitance smaller than 1 pF and for X modulation were developed. Together with these techniques, a process for implementing a p-n isolated high frequency transistor in a DIL 16 assembly mounted on a ceramic substrate was considered. Test results show that this air isolation process gives transistors with a transient frequency of 9 Ghz, the geometry of the transistor emitters is 2 microns. Furthermore, by modification of the p-n isolation process, Schottky ringmixers (cutoff frequency > 8 GHz) and tunable diodes were realized. The possibility of combining high frequency transistors, Schottky ringmixers, and/or tunable diodes in one chip thus follows. Author (ESA)

N80-29601# AEG-Telefunken, Backnang (West Germany). Fachbereich Weitverkehr und Kabeltechnik.

UNIVERSAL BUILDING BLOCKS FOR TANTALUM THIN FILM TECHNOLOGY Final Report, Dec. 1978

Wernfried Bonk, Hermann Griesinger, and Gerhard Ketterer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-76) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34,85

From a single amplifier RC filter, configuration circuits accomplishing the typical second degree transfer functions such as lowpass, highpass, bandpass, allpass, and band reject are derived and optimized with respect to sensitivity. The introduction of an additional amplifier leads to a filter concept for higher pole-Q s. The individual filter circuits are combined in highly versatile standard building blocks which can be adjusted to a specific application by means of trimming resistors and appropriate external interconnections. Tantalum film technology was used in developing the hardware of the building blocks. Resistors were made of TaN and TaON. For the capacitors beta-Ta was used initially as the basic material. Later on N-doped Ta was introduced due to its superior properties. Results meet the design objectives for the thin film network being small size, high precision, and good temperature, as well as longterm stability. Author (ESA)

N80-29602# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.

MOS-LSI DEVELOPMENT PROBLEMS Final Report, Sep. 1977

Karl Arnold, Helmut Gueckel, Hans Eberhard Longo, Horst Panholzer, Peter Radermeyer, Erich Rosshaupter, Juergen Schaedel, and Jacobus W. Scholtens Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 61 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-80) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12,60

Process engineering problems related to the development of CMOS gates and P-type MOS gates are studied. Existant manufacturing techniques are evaluated and improved as to yield, cost, and production time. Also improved is the quality of the MOS integrated circuits which are fabricated using these processes. Main results center on changes in cleaning procedures, the use of 3 in. instead of 2 in. silicon wafers for photolithography, ion implantation, metallization, and process control to stabilize electric parameters of the integrated circuits. Author (ESA)

N80-29603# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Munich (West Germany). Inst. fuer Festkoerpertechnologie.

SEMICONDUCTOR TECHNOLOGY OF ION IMPLANTED SILICON DEVICES Final Report, Mar. 1978

Josef Goetzlich, Anton Heuberger, Helmut Kranz, Bernd Schubert, and Franz Soller Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 91 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-81) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18,90

The influence of ion implantion on various processes in the production of bipolar silicon devices was investigated. Results show that the oxidation behavior of ion implanted silicon layers exhibits an enhancement of the oxidation rate depending on ion species, ion energy, and ion dose. An evaluation of the segregation coefficient of As at the SiO2/Si interface demonstrates that segregation stronly affects the oxidation rate. Evaluation of the profile of knocked-on oxygen and nitrogen atoms from SiO2 and Si3N4 layers on silicon substrates shows that the dose of the knocked-on atoms is approximately as high as the dose of the primary ions if the thickness of the layer corresponds to the projected range of the implanted ions. Measurements of the pipe density of n-p-n structures in epitaxial layers with implanted subcollectors shows that arsenic as a subcollector dopant causes fewer cristallographic defects than antimony. The use of experimental results on oxidation rate and segregation coefficient for the development of silicon devices by means of process modeling is discussed. Author (ESA)

N80-29604/j National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jul. 1977 - Feb. 1980
William E. Reed Apr. 1980 211 p Supersedes NTIS/PS-79/0295; NTIS/PS-78/0307 2 Vol.
(PB80-809916; NTIS/PS-79/0295; NTIS/PS-78/0307) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

The technology, design, fabrication, and applications of charge transfer devices are presented in the cited research reports. Applications include imaging, signal processing, detectors, filters, amplifiers, and memory devices. This updated bibliography contains 107 abstracts, all of which are new entries to the previous edition. GRA

N80-29605/j National Technical Information Service, Springfield, Va.
CHARGE TRANSFER DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1978 - Mar. 1979
William E. Reed Apr. 1980 163 p 2 Vol.
(PB80-809924) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Research reports from worldwide literature are cited which cover the technology, design, fabrication, and applications of charge transfer devices. Applications include image devices, signal processors, amplifiers, filters, and memory devices. This updated bibliography contains 157 abstracts, none of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-29606 Stanford Univ., Calif.
STABILITY IN SPHERICAL SYSTEMS. 1: HYDRODYNAMIC STABILITY OF THIN, SPHERICALLY CONCENTRIC FLUID SHELLS. 2: GLOBAL STABILITY OF TRANSIENT DROP EXTRACTION Ph.D. Thesis
John Frederick Patzer, II 1980 129 p
Avail: Univ. Microfilms Order No. 8016859

Two studies of hydrodynamic stability in spherical systems were conducted. The first considers the problem of thin film stability in spherically concentric fluid shells by means of the traditional linear hydrodynamic stability theory. Experimental observations confirmed that the critical thickness at rupture is independent of the hydrodynamic interfacial stress condition. However, film thicknesses at rupture were about five times greater than predicted due to nonspherical concentricity of the fluid phases in the experiment. The second study uses the nonlinear method of energy to examine the stability of transport in a drop characterized by an impulsive change in boundary temperature or concentration. Instabilities driven by interfacial n gradients are considered for two diffusive base states: the stagnant spherical drop model proposed by Newman and the circulating drop model of Kronig and Brink. Stability curves generated clearly show the presence of an onset time and a decay time for the disturbances. Comparison with limited available experimental data shows that qualitative prediction based upon the theory are observed experimentally. Dissert. Abstr.

N80-29607 Rice Univ., Houston, Tex.
A NUMERICAL STUDY OF NONLINEAR VISCOELASTIC FLOW AND NONISOTHERMAL POWER-LAW FLOW Ph.D. Thesis
Yow-Think Lin 1980 110 p
Avail: Univ. Microfilms Order No. 8018066

The energy equation for power law fluids is solved under various circumstances including a temperature dependent viscosity, viscous dissipation and heat convection across streamlines induced by the abrupt change of boundary temperature and subsequent velocity field rearrangement. In addition to the numerical solutions given, an analytical approximation method for the Graetz-Nusselt problem is also presented for comparison. This method divides the domain sections for which two corresponding solutions, approximated by polynomials, are solved by a thermal boundary layer theory and an integral method respectively. These two approximate solutions are then matched at the intersection to give a continuous and consistent temperature profile. Although the analytical solutions application is limited to the case with a temperature independent viscosity, this simple analysis is believed to be better than the previous methods available in the literature. Dissert. Abstr.

N80-29608 Houston Univ., Tex.
FLUID MECHANICS AND HEAT TRANSFER IN A FLUIDIZED COUNTER CURRENT BED Ph.D. Thesis
Partha Pratim Maitra 1979 192 p
Avail: Univ. Microfilms Order No. 8014106

The transfer of heat to a fluidized bed from larger and/or denser particles passed continuously downwards through the bed and removed from below was investigated. The research focuses on the mass holdup of the descending particles and the maximum attainable flow rates of these particles. An experimental apparatus was designed and constructed to obtain mass holdup and limiting flow rate data for several pairs of particles. The effects of the air flow rate, and of the feed rate, diameter and density of the descending particles on their holdup was investigated. The limiting feed rate for the descending particles was also determined and fitted by an empirical equation. Experiments were conducted in a two dimensional test bed to elucidate the mechanism of descent and the interaction between bubbles and the descending particles. Dissert. Abstr.

N80-29609 Illinois Univ. at Urbana-Champaign.
STUDY OF TURBULENT STRUCTURE CLOSE TO A WALL USING CONDITIONAL SAMPLING TECHNIQUES Ph.D. Thesis
Kenneth Kailung Lau 1980 159 p
Avail: Univ. Microfilms Order No. 8017967

Experiments were carried out in which the velocity at a number of locations in the fluid was measured simultaneously with the measurement of the two components of the fluctuating velocity gradient at the wall sx and sz. Using multiple-point measurements and conditional sampling both the kinematics and the dynamics of the wall eddies could be studied. Results confirm that counterrotating eddies in the wall region do exist; but rather than being the dominant flow structure, they exist only for short periods during transition between inflow and outflow. These profiles are in excellent agreement with our proposed idealized eddy pattern and the temporal development of these profiles shows that eddy evolution is influenced by the dynamics of flow in the spanwise direction. Simultaneous measurements using hot film probe in the fluid indicate that the direction of propagation of the wall flow is from the outer region. This is in contrast to suggestions that secondary flow is initiated by an instability at the wall. Positive shear layers are frequently encountered and negative shear layers can be present when fluid near the wall has a higher momentum content than fluid away from the wall. Dissert. Abstr.

N80-29610 Columbia Univ., New York.
A THEORECTICAL DISSERTATION ON THE CHARACTERISTICS OF THE FORCED CONVECTION ELECTRIC CATHODE PLASMA ARC Ph.D. Thesis
John Eugene Fink 1980 119 p
Avail: Univ. Microfilms Order No. 8016948

A mathematical model for a forced convection electric cathode plasma arc is presented. The geometry of the system to be analyzed is based on a technique which has demonstrated the capability of having a gas stream injected into the core of the arc column around a cathode electrode with a high degree of penetration without affecting the arc stability. The analysis consists of assuming the plasma arc to be a continuous fluid and solving simultaneously the conservation equations of mass, momentum, energy, and charge using a finite difference iteration scheme. The form of the charge conservation equation is derived from the divergence of the current density being zero for a steady state condition. The charge equation was based upon the most

complete current density expression to date and includes terms for ohmic, thermoelectric, and self magnetic current densities. Fundamental knowledge about the relationships and variations of heat transfer, fluid flow, electric, magnetic, and radiation phenomena within the plasma arc was obtained. The results produced include the distributions of the characteristic temperature, velocity, electrical, and magnetic intensity of the plasma arc for the fluid convection cathode system. Dissert. Abstr.

N80-29611 Illinois Univ. at Urbana-Champaign.
THE BLAST WAVE PRODUCED BY BURSTING SPHERES WITH SIMULTANEOUS OR DELAYED EXPLOSION OR IMPLOSION OF THE CONTENTS Ph.D. Thesis
Shirish Ambadas Shimpi 1980 238 p
Avail: Univ. Microfilms Order No. 8017983

High effective normal burning velocities are required to produce damaging blast waves. Constant velocity explosions have much higher peak overpressures than constant velocity implosions except near the center of the source where the reflected waves from an implosion cause high peak overpressures. A bursting sphere with immediate explosion of the contents produces a lead wave which is totally bursting sphere related with a secondary combustion wave which always trails the lead wave for low flame velocities. For the corresponding implosion case with sphere burst, the implosion process contributes to the peak overpressures even for relatively low flame velocities. It was noted that accelerating flames whether implosive or explosive, show that the maximum overpressure generated by such flames is no higher than that generated by a constant velocity flame which travels through the entire source region at the maximum velocity reached when the acceleration process ceases. The energy scaled impulse versus energy scaled radius show far field equivalency for all the cases considered. Dissert. Abstr.

N80-29612 Michigan Univ., Ann Arbor.
STUDY OF TURBULENT STRUCTURE WITH HOT-WIRES SMALLER THAN THE VISCOUS LENGTH Ph.D. Thesis
Lalit Kumar Sharma 1980 174 p
Avail: Univ. Microfilms Order No. 8017364

Measurements of the mean velocity profile and streamwise turbulence intensity profile are reported with the small U probes. Comparison of the turbulent intensity data with larger probes shows that the smaller probes measure more energy due to their better spatial resolution. The data measured by the small probes are also analyzed to determine the burst frequency at various distances from the wall and at two Reynolds numbers. The results show that the burst frequency scaled with respect to the wall parameters is less a function of Reynolds number than the burst frequency scaled with respect to the outer flow variables. To obtain more quantitative information regarding the turbulence structure, measurements are reported with two small U probes. From the correlation coefficient deduced from the measured data, it concluded that the turbulence structure increases in size in both the spanwise and transverse direction as the distance from the wall increases. Dissert. Abstr.

N80-29613 Georgia Inst. of Tech., Atlanta.
AN INTEGRAL-REPRESENTATION APPROACH FOR TIME-DEPENDENT VISCOUS FLOWS Ph.D. Thesis
Yehia M. Attia Rizk 1980 163 p
Avail: Univ. Microfilms Order No. 8018156

Numerical solutions for the laminar, incompressible flow around a two dimensional solid body are developed and presented. The equations of motion are formulated in the unsteady form. The body is assumed to impulsively start and the desired solution is obtained by forward marching in time. The present scheme is based on portioning the problem into a kinematic part and a kinetic part through the use of the vorticity and velocity as the dependent variables. The flow field is divided into two regions; an inner region immediately adjacent to the body and an outer region far from the body. An integral relation for the kinetic part is developed and it is combined with an available integral relation for the kinematic part to solve for the vorticity and velocity in the inner region. Finite differences techniques are used to solve the equations of motion in the outer region. The validity of the method is demonstrated by solving the flow over a flat plat at zero angle of attack and the flow around a circular cylinder. The numerical results obtained from the method are compared with available data and other numerical solutions. Dissert. Abstr.

N80-29614 Tennessee Univ., Knoxville.
NOSE-TIP TRANSITION STUDIES IN AN AEROBALLISTIC RANGE: A FEASIBILITY INVESTIGATION Ph.D. Thesis
John Thomas Miller 1973 288 p
Avail: Univ. Microfilms Order No. 8018488

Conventional optical flow-field observations are shown to have applicability only up to model velocities of 4500 ft/sec. At this velocity the bow shock image merges with the model silhouette so that flow-field details cannot be visible between the bow shock and the model surface. Satisfactory agreement is shown between ballistic range data and wind tunnel data at similar conditions. Heat transfer distribution measurements are used to deduce the location of boundary layer transition at realistic test velocities of 12,800 to 18,500 ft/sec. The significant results include larger than expected turbulent heating rates and boundary later transition locations further forward than would be predicted from lower velocity test data. Experimental heat transfer distributions are obtained from the thermal response of the test model surface to aerodynamic heating. Techniques developed to determine in-flight model surface temperatures include a surface melting technique and the use of a photoelectric pyrometer device. Dissert. Abstr.

N80-29615 Illinois Univ. at Urbana-Champaign.
HEAT TRANSFER IN LAMINAR SOLID-FLUID SUSPENSION FLOW Ph.D. Thesis
Chang Wook Sohn 1980 169 p
Avail: Univ. Microfilms Order No. 8017986

Effective thermal conductivities of neutrally buoyant concentrated polyethylene suspensions in silicone oil and kerosene mixture, and polystyrene suspensions in silicone oil and freon 113 mixture were measured in a rotating Couette flow apparatus. Contrary to the case of single phase fluid, effective thermal conductivity was observed to be shear dependent when the particle Peclet numbers are high. Measured particle volume fractions were psi = 0.15 and 0.30 for the suspensions of polyethylene beads (2.9 mm in diameter), and psi = 0.15 for the suspensions of polystyrene beads (0.3 mm in diameter). The case for psi = 0 (single phase liquid mixture only) was also measured in various shear rates to show the independence of thermal conductivity of single phase fluid on shear rates. The dependence of conductivity on particle Peclet number appeared to approach a power law relationship for the range of high Peclet numbers (Pe sub d > 300). Dissert. Abstr.

N80-29616 Rice Univ., Houston, Tex.
HIGHER ORDER DIFFERENTIAL APPROXIMATION OF RADIATIVE ENERGY TRANSFER IN A CYLINDRICAL GRAY MEDIUM Ph.D. Thesis
James K. D. Higenyi 1980 147 p
Avail: Univ. Microfilms Order No. 8018056

The spherical harmonics method is applied to develop and solve approximate differential equations of radiative transfer in an emitting, absorbing, isotropically scattering, and gray medium. Boundary conditions of Marshak type consistent with a particular approximation are derived and used in the solutions. Three types of thermal conditions for the medium are considered: radiative equilibrium, uniform heat generation and a parabolic internal heat generation. Two higher order approximations, P3 and P5 approximations, are formulated and solved for one dimensional problems; the medium is bounded by concentric or hollow cylindrical surfaces. Numerical results exhibit great improvement for the P3 approximation over the P1 approximation and a less rapid improvement for the P5 approximation. An axially symmetric problem is also analysed. In this case, only the P1 approximation is considered for a gray medium within a finite hollow or finite concentric cylindrical enclosure. Dissert. Abstr.

N80-29617 Arizona State Univ., Tempe.
HEAT TRANSFER CHARACTERISTICS OF THE TWO-PHASE CLOSED THERMOSYPHON (WICKLESS HEAT PIPE) INCLUDING DIRECT FLOW OBSERVATION Ph.D. Thesis
Frank Edward Andros 1980 367 p
Avail: Univ. Microfilms Order No. 8018463

The two phase closed thermosyphon is a heat transfer device

capable of transferring large quantities of heat from a source to a sink by taking advantage of the high heat transfer rates associated with the evaporation and condensation of a working fluid within the device. For small and intermediate fill quantities, four basic flow regimes were observed in the evaporator section of the thermosyphon during steady state operation with Freon 113 and ethanol: (1) a smooth continuous film with surface evaporation; (2) the breakdown of the smooth continuous film into a series of rivulets; (3) a wavy film with unstable rivulets; and (4) a wavy film with bubble nucleation occurring in the unstable rivulets. A fifth condition which was observed with all fluids was a dry out (heat transfer limit) where some portion of the evaporator ceases to be cooled effectively by the falling film and rivulets, resulting in a wall temperature excursion or critical condition. Three types of dry out were observed. In addition to the visual device used, a stainless steel tubular opaque device was fabricated and is heat transfer characteristics evaluated using Freon 113 as a working fluid. Dissert. Abstr.

N80-29618 Illinois Univ. at Urbana-Champaign.
EXPERIMENTAL AND MODELING STUDIES OF TWO-POINT STOCHASTIC STRUCTURE IN TURBULENT PIPE FLOW Ph.D. Thesis
Yassin Abdel-Rahim Hassan 1980 209 p
Avail: Univ. Microfilms Order No. 8017949

Large scale eddies of turbulent structure far from the wall region were studied in a vertical fully developed water pipe flow (D = 10.16 cm). The turbulent structure was investigated using space and space time correlations. The axial and radial velocity components were obtained simultaneously at two points in the flow field with two hot film anemometers x-probes. Departure of these two point correlations from isotropic behavior was modeled in terms of axisymmetric tensor forms, in which the turbulence is characterized by two scalar quantities defined by four free parameters which are related to the correlation length scales. Conditional averages of the velocity components were measured for both time delay and spatial separation. Comparisons of these conditional averages with their computed linear and second order nonlinear estimates, utilizing the mean square stochastic error approximation, showed good agreement. Linear estimation combined with the time series was used to produce a typical sequence of conditional eddy patterns which show strong resemblance with turbulence structures from flow visualization studies. Dissert. Abstr.

N80-29619 Engineering Sciences Data Unit, London (England).
MEAN FLUID FORCES AND MOMENTS ON RECTANGULAR PRISMS: SURFACE-MOUNTED STRUCTURES IN TURBULENT SHEAR FLOW
1980 22 p
(ESDU-80003; ISBN-0-85679-285-3; ISSN-0141-4003; ISSN-0141-397X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

Means for estimating the mean forces and moments induced by a turbulent shear flow on surface mounted rectangular prisms are provided. A typical application is to a rectangular building or tower in the natural wind, but the data can also be used with fluids other than air. This information is required when estimating, for example, the along wind response of a building block to turbulence at the maximum design wind speed as detailed. In this case however, the response due to other excitation mechanisms, such as vortex shedding and galloping, should also be investigated. ESDU

N80-29620 Stanford Univ., Calif.
JOULE HEATING EFFECTS IN THE ELECTRODE WALL BOUNDARY LAYER OF MHD GENERATORS Ph.D. Thesis
Richard Kent James 1980 209 p
Avail: Univ. Microfilms Order No. 8016835

Two models were examined that are suitable for large scale magnetohydrodynamic (MHD) generator calculations. The first model was an integral model using 1/7th power profiles and accounted in an approximate manner for electron nonequilibrium and for the effects of near wall Joule heating. The second model was a full two dimensional boundary layer model, including solution of the electron continuity equation. Comparisons of predictions between the two models generally showed good agreement. Measurements were performed of temperature and electron number density profiles on a laboratory scale MHD generator. Comparisons between calculations from the two dimensional theory and measurments for cases without current generally showed good agreement when the turbulence model properly accounted for effects of free stream turbulence. Measurements of electron number density profiles indicated that some degree of nonequilibrium existed near the wall, but the effect was small. Dissert. Abstr.

N80-29621 Catholic Univ. of America, Washington, D. C.
THE MEASUREMENT OF DISPERSIVE WAVES WITH A REAL-TIME WAVE VECTOR ANALYZER Ph.D. Thesis
Carl Anthony Cascio 1980 123 p
Avail: Univ. Microfilms Order No. 8018345

A parallel input/serial output charge coupled device (CCD) was introduced which provides a simplified real time electronics package that is capable of sampling and then delaying the signals from an array of sensors. The device was operated as an eight channel beamformer sampling at rates up to 1 MHz with time delays ranging from 1 to 800 microseconds. An accelerometer array formed a wave vector filter whose spatial properties were controlled by the selection of a master clock frequency. A real time wave vector analyzer was then created by following the output of the CCD beamformer with a set of 1/3 octave filters that allowed the wave number to be varied from 25 to 125. The dispersive nature of the wave propagation in the plate was resolved by assuming a reasonable formulation of the dispersion and then creating a simple algorithm to generate the clock frequencies appropriate to an angular display of the wave vector response. Using a line array the steerable wave vector analyzer was shown to accurately localize a vibration source for three levels of damping in the plate. Dissert. Abstr.

N80-29622*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TURBULENT STRUCTURES IN WALL-BOUNDED SHEAR FLOWS OBSERVED VIA THREE-DIMENSIONAL NUMERICAL SIMULATORS
A. Leonard Jul. 1980 30 p refs Presented at Turbulence Conf.: The Role of Coherent Structures in Modeling of Turbulence and Mixing, Madrid, 25-27 Jun. 1980
(NASA-TM-81219; A8280) Avail: NTIS HC A03/MF A01 CSCL 20D

Three recent simulations of tubulent shear flow bounded by a wall using the Illiac computer are reported. These are: (1) vibrating-ribbon experiments; (2) study of the evolution of a spot-like disturbance in a laminar boundary layer; and (3) investigation of turbulent channel flow. A number of persistent flow structures were observed, including streamwise and vertical vorticity distributions near the wall, low-speed and high-speed streaks, and local regions of intense vertical velocity. The role of these structures in, for example, the growth or maintenance of turbulence is discussed. The problem of representing the large range of turbulent scales in a computer simulation is also discussed. R.K.G.

N80-29623*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TOWARD THE USE OF SIMILARITY THEORY IN TWO-PHASE CHOKED FLOWS
R. C. Hendericks, J. V. Sengers (Maryland Univ., College Park), and R. J. Simoneau 1980 12 p refs Proposed for presentation at Winter Ann. Meeting of the ASME, Chicago 16-21 Nov. 1980
(NASA-TM-81568) Avail: NTIS HC A02/MF A01 CSCL 20D

Comparison of two phase choked flows in normalized coordinates were made between pure components and available data using a reference fluid to compute the thermophysical properties. The results are favorable. Solution of the governing equations for two LNG mixtures show some possible similarities between the normalized choked flows of the two mixtures, but the departures from the pure component loci are significant. Author

N80-29624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY RESULTS FROM A FOUR-WORKING SPACE, DOUBLE-ACTING PISTON, STIRLING ENGINE CONTROLS MODEL

Carl J. Daniele and Carl F. Lorenzo 1980 17 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980

(Contract EC-77-A-31-1040)

(NASA-TM-81569; DOE/NASA/1040-17; E-534) Avail: NTIS HC A02/MF A01 CSCL 20D

A four working space, double acting piston, Stirling engine simulation is being developed for controls studies. The development method is to construct two simulations, one for detailed fluid behavior, and a second model with simple fluid behaviour but containing the four working space aspects and engine inertias, validate these models separately, then upgrade the four working space model by incorporating the detailed fluid behaviour model for all four working spaces. The single working space (SWS) model contains the detailed fluid dynamics. It has seven control volumes in which continuity, energy, and pressure loss effects are simulated. Comparison of the SWS model with experimental data shows reasonable agreement in net power versus speed characteristics for various mean pressure levels in the working space. The four working space (FWS) model was built to observe the behaviour of the whole engine. The drive dynamics and vehicle inertia effects are simulated. To reduce calculation time, only three volumes are used in each working space and the gas temperature are fixed (no energy equation). Comparison of the FWS model predicted power with experimental data shows reasonable agreement. Since all four working spaces are simulated, the unique capabilities of the model are exercised to look at working fluid supply transients, short circuit transients, and piston ring leakage effects. Author

N80-29625# Ohio State Univ., Columbus. The Aeronautical and Astronautical Research Lab.

FLUID DYNAMICS OF MULTIPLE NOZZLE ARRAYS AND RADIAL FLOW DIFFUSERS Final Report, 1 Oct. 1977 - 31 Dec. 1979

S. L. Petrie and J. D. Lee Apr. 1980 28 p

(Grant AF-AFOSR-2956-76; AF Proj. 2307)

(AD-A085672; AFOSR-80-0456TR; OSURF-784336) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report summarizes the theoretical and experimental research dealing with the fluid dynamical interactions in free shear layers and diffuser-ejectors. The objectives of this research were (a) to provide characterization of the fluid dynamical mixing layers typical of those in supersonic transfer lasers and in mixing gas dynamic lasers, and (b) to examine the mixing and induction characteristics of ejectors capable of providing pressure ratios typical of those associated with radial flow laser diffusers. GRA

N80-29626# Montana State Univ., Bozeman. Supersonic Wind Tunnel Lab.

NECESSARY CONDITIONS FOR TRANSITION IN A FREE SHEAR LAYER Scientific Report, 1 Aug. 1979 - 31 Jan. 1980

Anthony Demetriades Feb. 1980 57 p refs

(Contract F49620-79-C-0210; AF Proj. 2307)

(AD-A085514; SWT-80-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

A necessary condition for the preservation of turbulence has been utilized to predict laminar-turbulent transition in free shear, or mixing, layers. Following earlier applications in wakes and boundary layers, the condition is expressed in terms of a threshold turbulence Reynolds number which can be computed if the turbulence properties of the post-transitional flow are known. Assuming that the latter are those reported for self-similar flows, general rules for transition in all major types of shear flows are drawn. Numerical computations are presented for arbitrary homogeneous free shear layer transition identified as the most forward permissible turbulence onset location. Transition is found to move downstream very rapidly as the fast-stream Mach number is increased and the speed ratio is decreased, and less rapidly as the slow stream is heated. Agreement with available transition data is qualitatively good but quantitatively fair, which is ascribed to missing information about the shear layer turbulence and the observed tendency of available transition data to depend on the Reynolds number. GRA

N80-29627# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

NUMERICAL SOLUTION OF THE AZIMUTHAL-INVARIANT THIN-LAYER NAVIER-STOKES EQUATIONS Final Report

Charles J. Nietubicz, Thomas H. Pulliam, and Joseph L. Steger Mar. 1980 37 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A085716; AD-E430444; ARBRL-TR-02227) Avail: NTIS HC A03/MF A01 CSCL 20/4

A numerical procedure is developed for a two dimensional azimuthal (or planar) invariant form of the thin-layer Navier-Stokes equations. The governing equations are generalized over the usual two dimensional and axisymmetric formulations by allowing non zero velocity components in the azimuthal direction. The equations are solved with an implicit approximate factorization finite-difference scheme. Inviscid and viscous results are presented for both external and internal flows, for spinning and non-spinning bodies. GRA

N80-29628# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

LASER VELOCIMETER MEASUREMENTS IN TURBULENT AND MIXING FLOWS, PART 2 Interim Report, 1 Oct. 1978 - 15 Dec. 1979

Warren H. Stevenson, H. Doyle Thompson, Robin Bremmer, and Timothy Roesler Wright-Patterson AFB, Ohio AFAPL Mar. 1980 75 p refs

(Contract F33615-77-C-2010; AF Proj. 2308)

(AD-A085344; AFAPL-TR-79-2009-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental and analytical study of subsonic flow over a rearward facing step is reported. A major emphasis of the work is the investigation of bias errors in mean velocities obtained from laser doppler velocimeter (LDV) measurements in such highly turbulent flows. Optical alignment of the specially designed LDV used in the study is described in detail. An analysis of the biasing problem is presented and preliminary measurements which appear to confirm previously predicted velocity bias errors are reported. Results of a computer model developed to describe the flow are presented together with preliminary static pressure measurements made in the flow facility. GRA

N80-29629# Colorado School of Mines, Golden.

EXPERIMENTAL DESIGN FOR HYDRAULIC TRANSPORT RESEARCH FACILITY Final Technical Report

Robert R. Faddick, ed. Dec. 1979 170 p refs

(Contract ET-78-S-01-3274)

(FE-3274-1) Avail: NTIS HC A08/MF A01

A research program was to be defined for the operation of the newly constructed Hydraulic Transport Research Facility (HTRF). The program was to be designed to obtain engineering data for the design of efficient, economical, and reliable new coal hydraulic haulage systems from the mine face to the wash plant. The research program was to be completed in the shortest feasible time and at the lowest operating cost. A five year experimental design consisting of three phases was developed. After a two month calibration period, Phase 1 (first year) tests all three pipeline diameters with both a washed and unwashed coal at varying slurry concentrations. Head losses, deposition velocities, and exploratory work on flow transients constitute the test program. Phase 2 (second year) allows for implementation of the data logger for examination of particle size distribution and flow transients. Phase 2 (next three years) comprises a definitive study on transients, particle size, and studies different coals and coal-refuse mixtures. New technology is also to be examined. It is recommended that a separate analytical team be from the current contractor team to coordinate the data generated by the HTRF and develop it for industry's use. DOE

N80-29630# Oak Ridge National Lab., Tenn.

COMPUTER MODEL FOR SELECTIVE FLOW MEASURING STRUCTURES IN OPEN CHANNELS

M. J. Hickey 1980 5 p refs Presented at the UCC-ND and GAT Waste Management Seminar Program, Portsmouth, Ohio, 22 Apr. 1980

(Contract W-7405-eng-26)

(CONF-800416-7) Avail: NTIS HC A02/MF A01

Quantifying various pollutants in natural waterways has

received increased emphasis with more stringent regulations issued by the Environmental Protection Agency (E.P.A.). Measuring natural stream flows presents a magnitude of problems, the most significant is the type of structure needed to measure the flows at the desired level of accuracy. A computer model designed to select a structure to best fit the engineer's needs is under development. This model, given the pertinent boundary conditions, will pinpoint the structure most suitable, if one exists. This selection process greatly facilitates the old selection process of trial and error. DOE

N80-29631# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
NONSTATIONARY FILTRATION IN PARTIALLY SATURATED POROUS MEDIA
C. J. vanDuyn and L. A. Peletier May 1979 36 p refs Submitted for publication
(MC-TW-189/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

From the mathematical formulation of a one dimensional flow through a partially saturated porous medium, a nonlinear free boundary problem is posed, the boundary being between the saturated and the unsaturated regions in the medium. In particular, an equation which is parabolic in the unsaturated part of the domain and elliptic in the saturated part is obtained. Existence, uniqueness, a maximum principle, and regularity properties are proved for weak solutions of a Cauchy-Dirichlet problem in the cylinder $(x,t) : 0 < \text{or} = X < \text{or} = 1, T > \text{or} = 0$ and the nature, in particular the regularity, of the free boundary is discussed. Finally, it is shown that solutions of a large class of Cauchy-Dirichlet problems converge towards a stationary solution as t tends to infinity. Estimates are given for this rate of convergence. Author (ESA)

N80-29632# National Technical Information Service, Springfield, Va.
CAVITATION: CAVITATION FLOW. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - Apr. 1980
Guy E. Habercom, Jr. May 1980 261 p Supersedes NTIS/PS-79/0327; NTIS/PS-78/0258
(PB80-810567; NTIS/PS-79/0327; NTIS/PS-78/0258) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Reports on general aspects of cavitating flow are included. A wide range of theoretical, analytical, and experimental information is presented involving mathematical analysis, computer programs, and testing. Topics include marine engineering, hydrodynamic and aerodynamic configurations, symmetric and nonaxisymmetric shapes, and measuring technology. Data is given on surface piercing struts, helical inducers, pumps, liquid metal systems, and venturi tubes. Applications include dam outlets and spillways, vertical conduits, deep rock drilling, heat pipe stability, water entry, and liquid croygenic systems. Discussions are made of flow characteristics, noise, nucleate boiling, perturbation problems, and allied subjects. This updated bibliography contains 253 abstracts. GRA

N80-29633# National Technical Information Service, Springfield, Va.
CAVITATION: HYDROFOILS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Guy E. Habercom, Jr. May 1980 202 p Supersedes NTIS/PS-79/0328; NTIS/PS-78/0259
(PB80-810575; NTIS/PS-79/0328; NTIS/PS-78/0259) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Studies are presented on the cavitation characteristics of various classes of hydrofoils such as fully submerged, ventilated, high speed, supercavitating, and jet flapped. Surface piercing struts are studies. Test facilities, models, and test methods are described. Lift, drag, oscillation, flutter, heaving, hydroelasticity, and loading are discussed. Other topics include entrainment, bubbles, unsteady forces, flow fields, sea states, cavitation noise, mathematical models, and boundary layers, along with investigations of hydrofoil craft performance. This updated bibliography contains 194 abstracts, 9 of which are new entries to the previous edition. GRA

N80-29634# Hawaii Univ., Honolulu. Sea Grant Coll. Program.
BUBBLE NUCLEATION IN SUPERSATURATED FLUIDS
Thomas D. Kunkle Dec. 1979 124 p refs
(Grants NOAA-04-3-158-29; NOAA-04-5158-17; NOAA-04-6-158-44026; NOAA-04-6-158-44114, NOAA-04-7-158-44129)
(PB80-184773; UNIHI-SG-TR-80-01; NOAA-80040710) Avail: NTIS HC A06/MF A01 CSCL 06A

An introduction to the physics of bubbles is followed by an outline of the theory of homogeneous nucleation. The results of an experimental program in which transparent gelatin was used to stabilize bubbles against floatation are reported. The existing models of cavitation nuclei are classified into four major groups, and each group is briefly discussed. The principal thesis that the cavitation nuclei present in common fluids consist of spherical gas phases encased in monomolecular skins of surface-active molecules is advanced. The surface-active material forming the skin of the nuclei observed in gelatin is shown to be similar to several commonly occurring surfactants, namely the saturated lecithins and phosphatidylethanolamines. The application of the results to the study of decompression sickness is explored. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-29635*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW INTENSITY X-RAY AND GAMMA-RAY IMAGING SPECTROMETER Patent Application
Lo I. Yin, inventor (to NASA) Filed 30 Jul. 1980 29 p
(NASA-Case-GSC-12587-1; US-Patent-Appl-SN-173524) Avail: NTIS HC A03/MF A01 CSCL 14B

An imaging spectrometer includes a shield which is opaque to visible light and tranparent to X-ray or gamma-ray photons, and a scintillator which converts the X-ray or gamma-ray photons to visible-light photons. An input fiber optics plate guides the visible light pohotons in the same spatial position to photo-cathode which coverts them to photoelectrons. A chevron, curved, or Z configuration microcahannel plate amplifier, operated far below saturation, but capable of a 10 to the 4th to 10 to the 7th power gain, receives the photoelectrons and intensifies them. The intensified electrons are then converted back to visible-light photons by an output phosphor screen. An output fiber optics plate guides the visible-lifght photons in the same spatial position to a digitizing video camera and a digital information processor which indicates the spatial position, number, and efficient energy of the incoming X-ray or gamma ray photons. NASA

N80-29636*# Information and Control Systems, Inc., Hampton, Va.
A PARAMETRIC STUDY OF ALIASING ERROR FOR A NARROW FIELD OF VIEW SCANNING RADIOMETER Final Report
Nesim Halyo and Steven T. Stallman Washington, D.C. Aug. 1980 81 p refs
(NASA-CR-3294; FR-47801) Avail: NTIS HC A05/MF A01 CSCL 14B

Starting from the general measurement equation, it is shown that a NFOV scanner can be approximated by a spatially invariant system whose point spread function depends on the detector shape and angular characteristics and electrical filter transfer function for given patches at the top of the atmosphere. The radiometer is modeled by a detector, electrical filter, analog to digital converter followed by a reconstruction filter. The errors introduced by aliasing and blurring into a reconstruction of the input radiant exitance are modeled and analyzed for various detector shapes, sampling intervals, electrical filters and scan types. Quantitative results on the errors introduced are presented showing the various tradeoffs between design parameters. The

results indicate that proper selection of detector shape coupled with electrical filter can reduce aliasing errors significantly.
Author

N80-29637*# Applied Science Associates, Inc., Apex, N. C.
WALLOPS WAVEFORM ANALYSIS OF SEASAT-1 RADAR ALTIMETER DATA Final Report
George S. Hayne Jul. 1980 44 p refs
(Contract NAS6-2810)
(NASA-CR-156869) Avail: NTIS HC A03/MF A01 CSCL 05B

Fitting a six parameter model waveform to over ocean experimental data from the waveform samplers in the SEASAT-1 radar altimeter is described. The fitted parameters include a waveform risetime, skewness, and track point; from these can be obtained estimates of the ocean surface significant waveheight, the surface skewness, and a correction to the altimeter's on board altitude measurement, respectively. Among the difficulties encountered are waveform sampler gains differing from calibration mode data, and incorporating the actual SEASAT-1 sampled point target response in the fitted wave form. There are problems in using the spacecraft derived attitude angle estimates, and a different attitude estimator is developed. Points raised in this report have consequences for the SEASAT-1 radar altimeter's ocean surface measurements are for the design and calibration of radar altimeters in future oceanographic satellites. Author

N80-29638# TriTec, Inc., Columbia, Md.
DEVELOPMENT OF A FLUIDIC GAS CONCENTRATION SENSOR Final Report
George E. Stevens and Maurice F. Funke Adelphi, Md. ERADCOM 16 Jun. 1980 60 p refs Sponsored in part by U.S. Geological Survey
(Contract DAAG39-78-C-0103)
(AD-A085777; HDL-CR-80-103-1) Avail: NTIS HC A04/MF A01 CSCL 13/7

This document is the final report of a program to design, test, and evaluate the performance of fluidic gas concentration sensing systems and their component parts for monitoring CxHy and H2S on offshore platforms. This program consisted of investigating three major portions of a systems: Gas Sensors, Chemical Processors and Sensor System. Three candidate fluidic sensors (Resistor Bridge Sensor, Vortex Sensor, Jet Edge Resonator Oscillator Sensor) were evaluated for use in the sensor system. The resistor bridge sensor was chosen as the most appropriate. Several chemical processors were evaluated for each gas sensing system. Palladium coated alumina was chosen for the CxHy system and lead acetate was chosen for the H2S systems. GRA

N80-29639# Naval Research Lab., Washington, D. C.
MAGNETO-OPTIC MATERIALS FOR BIASING RING LASER GYROS Interim Report
G. A. Prinz, J. J. Krebs, W. G. Maisch, and D. W. Forester 14 Apr. 1980 47 p refs
(Contracts N00019-80-WR-01055; WF-21234601)
(AD-A085476; AD-E000425; NRL-MR-4198; IR-2) Avail: NTIS HC A03/MF A01 CSCL 20/6

A series of new materials including alloys of transition metals (Fe, Co) with rare earths (Gd, Tb) have been fabricated and characterized. Analysis is provided of ellipsometric techniques used to obtain the magneto-optic properties. An improved definition of Figure-of-Merit for transverse Kerr effect mirror application. GRA

N80-29640# Harris Corp., Melbourne, Fla. Government Communication Systems Div.
WIDEBAND HOLOGRAPHIC DIGITAL RECORDING AND REPRODUCTION, PHASE 4 Final Technical Report, 28 Sep. 1978 - 15 Jun. 1979
L. M. Ralston and C. A. Shuman Feb. 1980 244 p refs
(Contract F30602-78-C-0344; AF Proj. 4594)
(AD-A086265; RADC-TR-80-15) Avail: NTIS HC A11/MF A01 CSCL 14/5

This study effort evaluates potential improvements to the performance of the Wideband Recorder (WBR) system. These potential improvements are in the areas of bit error rate (BER), data packing density, and system optical power efficiency. Improvements to corrected BER which can be obtained by deeper interleaving of the recorded codewords are described and data from experiments simulating this process are documented. A potential data packing density increase from a modification of the intensity profile of the recording beam is described and experimental results are presented. A reduction in raw BER which can be obtained by reduced data crosstalk is predicted, and the results of testing a new, low-crosstalk Acousto-Optic Page Composer (multichannel optical modulator) are presented. Finally a modification to the system's optical path which can reduce the optical power required for data recording is discussed. GRA

N80-29641# Sandia Labs., Albuquerque, N.Mex. Thermomechanical and Physical Research Div.
LABORATORY SYSTEM FOR TRANSIENT DIGITAL DATA RECORDING AND PROCESSING: HARDWARE AND SOFTWARE
David A. Benson and Gary D. Miller Feb. 1980 98 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0354) Avail: NTIS HC A05/MF A01

A digital data acquisition system designed to record and process transient signals for the Dynamic Heating Facility is described. It uses four commercial waveform recorder units to monitor up to 10 separate signal lines. An interface and file processor device was developed which permits rapid interactive transfer and labeling of data from these recorders. The data are permanently stored as disk files in the laboratory microcomputer. From these disk files, information can be rapidly transferred to the central computer via NOS. There, detailed analysis of the data as well as plotting and listing of reduced data can be efficiently carried out. This report presents procedures and software for the entire file transfer sequence through the interface and file processor, the lab microcomputer and through a companion FORTRAN IV processor program on NOS. Hardware developed for the interface and file processor system is also described.
DOE

N80-29642# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY OF A HELIUM GAS FILLING DEVICE FOR ASTRONOMICAL EXPERIMENTS Final Report, Dec. 1978
Bernd Hinderer, Hubert Koch, and Klaus Thalheimer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 58 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-12) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11,75

A gas pumping device useful for cyclic filling of optical analyzers up to a defined pressure was designed, manufactured, and successfully tested after fundamental investigations of different concepts and their components. The three development phases are described in detail. The final design of the breadboard model is based on the requirements of an astronomic sounding rocket experiment essentially demanding pressurization of a previously evacuated volume within an appointed time.
Author (ESA)

N80-29643# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.
INVESTIGATIONS ON THE LAYOUT OF A He(+) RESONANCE CELL Final Report
Hans Georg Hamacher Bundesmin. fuer Forsch. u. Technol. Oct. 1979 100 p refs In GERMAN; ENGLISH summary
(Contract BMFT-WRT-1074/1076)
(BMFT-FB-W-79-14) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,60

A resonance cell working with singly charged helium ions as resonant absorbers is proposed as an instrument for the high resolution analysis of helium-2 304 A radiation. Methods to ionize helium in a helium resonance cell are investigated. It is found that only ionization by energetic electrons promises the realization of sufficiently high ion densities for an effective modulation of the helium-2 304 A radiation. High frequency ionization is shown to be much more effective than ionization by static-field-accelerated electrons. Two types of resonance cells were built, one for a capacitive and one for an inductive high frequency energy coupling. The latter type of cell is demonstrated superior for the purpose of reaching high ion densities. Realized

ion densities above 30 billion/cu cm, yielding a 5 to 10% modulation of the helium-2 304 A radiation traversing the cell are reported. Possibilities to improve the technical layout of the cells that were tested experimentally are discussed.
Author (ESA)

N80-29644# National Technical Information Service, Springfield, Va.
APPLICATIONS OF HOLOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Apr. 1980
Brian Carrigan May 1980 67 p Supersedes NTIS/PS-79/0566: NTIS/PS-78/0561
(PB80-810674; NTIS/PS-79/0566; NTIS/PS-78/0561) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

The bibliography covers studies on the applications of holography in such areas as photographing high-speed particles, nondestructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement, and medical diagnosis. This updated bibliography contains 59 abstracts, 42 of which are new entries to the previous edition. GRA

N80-29645# National Technical Information Service, Springfield, Va.
APPLICATIONS OF HOLOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - 1980
Brian Carrigan May 1980 257 p
(PB80-810666) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

The bibliography covers studies on the applications of holography in such areas as photograping high-speed particles, nondestructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement, and medical diagnosis. This updated bibliography contains 249 abstracts, none of which are new entries to the previous edition. GRA

N80-29646# National Technical Information Service, Springfield, Va.
HOLOGRAPHIC THEORY AND RECORDING TECHNIQUES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Brian Carrigan May 1980 259 p Supersedes NTIS/PS-79/0601: NTIS/PS-78/0582
(PB80-810716; NTIS/PS-79/0601; NTIS/PS-78/0582) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

The topics cited include holographic recording techniques, theory, equipment, and materials. Among the techniques cited are color holography, X-ray holography, high speed holography, and motion picture holography. Photographic materials, films, emulsions, and equipment for recording and information storage are covered. Techniques for image motion compensation, image deblurring, wave-front reconstruction, and resolution are also cited. This updated bibliography contains 251 abstracts, 17 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-29647 Maryland Univ., College Park.
STUDY OF THE INTENSITY-DEPENDENT NONLINEAR INDEX AND ITS APPLICATION TO SOLIDS AND LIQUIDS Ph.D. Thesis
John William VanLaak 1979 237 p
Avail: Univ. Microfilms Order No. 8017190

Intense picosecond sideband radiation of about 10 KW/100 cm was observed from a mode locked Nd:glass laser and found to be temporally coincident with the 1.06 microns laser pulses that produce them. The mechanism producing the sidebands was identified to be self phase modulation of electronic origin. The temporal synchronization of the sideband and 1.06 microns pulses was utilized to generate upconverted radiation from 440 to 450 nm at about 1 KW/100 cm in ADP. Sum frequency generation in potassium pentaborate (RB5) was observed for three different optical mixing experiments and shown to agree with theory. Radiation was observed at the fourth and fifth harmonics of the 1.06 microns light from the mode locked Nd:glass laser. The upconverted power is shown to agree with the predicted value within experimental error. The optical Kerr constants of a variety of liquids was determined by inducing birefringence in them using a high power Q switched Nd:glass laser and observing enhanced signal from a He-Ne laser through crossed polarizers. Comparison of the measured and calculated Kerr constants show satisfactory agreement. Dissert. Abstr.

N80-29648 Illinois Univ., Urbana-Champaign.
VISIBLE-SPECTRUM INDIUM GALLIUM PHOSPHIDE ARSENIDE HETEROSTRUCTURE LASERS Ph.D. Thesis
Raymond Chin 1980 124 p
Avail: Univ. Microfilms Order No. 8017921

The growth, fabrication, and luminescence characteristics of wide-gap In(1-x)Ga(x)P(1-z)As(z) double heterojonction lasers and of single and multiple quantum well lasers are examined. The problems related to the substrate GaAs(1-y)Ply) used in visible laser diode work such as surface cross hatch structure and lattice parameters variation are examined. Comparisons are made between the active layers of DH structures grown from Ga rich melts and high arsenic concentration in rich melts. The specific difficulties related to each melt type are discussed, as well as growth temperature effects. The effects of lattice mismatch between the GaAs(1-y)Ply) substrate and the In(1-x)Ga(x)P epitaxial layers are studied, providing correlations between the photoluminescence intensity, surface features, and lattice mismatch. Data are presented for various visible spectrum double heterojunction lasers with different heterobarrier heights. Limitations upon the compositions which can be employed in DH lasers are discussed in terms of the direct indirect transition. Preliminary results from single and multiple quantum well lasers with high energy gaps are examined, as well as the method of growing them. Dissert. Abstr.

N80-29649 Georgia State Univ., Atlanta.
APPLICATION OF DOUBLE TORSION TEST TO INVESTIGATION OF THE FRACTURE BEHAVIOR OF CAST IRON Ph.D. Thesis
Deepak Kumar Verma 1980 206 p
Avail: Univ. Microfilms Order No. 8018157

The double torsion test can yield valid fracture toughness values provided all the experimental conditions outlined are satisfied such as avoiding torsional warping of plates, avoiding 'end effects', maintaining plane strain conditions, avoiding deep top and bottom grooves for thicker specimens, suitably modifying the standard calibration equation, avoiding excessive brinelling at loading points and proper machining of specimens. The double torsion test may be utilized to obtain valuable information upon the effects of as-cast section size and composition on the fracture toughness of gray cast ions. Both as-cast section size and carbon equivalent exert profound effects upon fracture toughness. Along with the effects of inoculation, those of as-cast section size and carbon equivalent, may be rationalized on the basis of coarseness and volume fracture of the weak graphite flakes present in the structure. The Hornbogen-Motz model may be applied with reasonable success to estimating the fracture toughness values. Knowing the eutectic cell of gray ions, the fracture toughness can be predicted with reasonable confidence. Dissert. Abstr.

N80-29650 Arizona Univ., Tucson.
INFRARED INTERFEROMETRIC SYSTEMS Ph.D. Thesis
Osuk Young Kwon 1980 181 p
Avail: Univ. Microfilms Order No. 8017755

Infrared interferometric systems using a CO2 laser operating at a wavelength of 10.6 micrometers were investigated. Specific systems developed were the infrared laser unequal path interferometer (IRLUP), the IRLUPI with infrared computer generated hologram, the infrared common path interferometers such as the infrared point diffraction interferometer, and the infrared scatterplate interferometer. The above interferometers produce interferograms of equal optical path difference (OPD). Other types of common interferometers which provide interferometers of differential OPD were also developed. They are infrared lateral shearing interferometers, a germanium plane parallel plate, the Ronchi ruling, and the double grating lateral shearing interferometer. A pyroelectric vidicon was employed as an ac infrared detector with proper intensity modulation techniques. Chopping, panning, and phase variation of the interferogram

modulated the interference pattern effectively for various types of interferometers. Germanium and zinc selenide optics were used for lenses and beamsplitters. A He-Ne gas laser was installed parallel to the CO2 beam for the ease of initial alignment. Test interferograms are shown using each interferometer.
Dissert Abstr.

N80-29651 Stanford Univ., Calif.
STUDIES OF LASER RESONATORS AND BEAM PROPAGATION USING FAST TRANSFORM METHODS Ph.D. Thesis
Shinan-Chur Sheng 1980 149 p
Avail: Univ. Microfilms Order No. 8016883

The quasi-fast Hankel transform (FHT) algorithm is improved and tested for beam propagation calculations in cylindrical coordinates in order to develop an efficient method for the numerical computation of optical diffraction effects. Accuracy criteria are established and relationships between optical Fresnel number and numerical sampling parameters are found. Extensive application of this propagation scheme to resonator eigenmode analysis is carried out. The analytic solutions of the perturbed Quassian modes of an unbalanced antiresonant ring laser cavity are studied by perturbation theory. This resonator has the property of exhibiting transverse mode selection even with infinite diameters for all mirrors and apertures. Second harmonic generation in nonlinear materials with beam diffraction, pump depletion, and arbitrary beam profiles all taken into consideration are investigated. Numerical calculations are done with the use of the FHT in cylindrical coordinates, and fast fourier transforms in rectangular coordinates. Theory is confirmed with an experiment using an unstable resonator Nd: YAG output beam pumping KDP crystal.
Dissert. Abstr.

N80-29652*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HETERODYNE SYSTEMS AND TECHNOLOGY, PART 1
Aug. 1980 266 p refs Intern. Conf. held at Williamsburg, Va., 25-27 Mar. 1980 2 Vol.
(NASA-CP-2138-Pt-1; L-13849) Avail: NTIS HC A12/MF A01 CSCL 20E

Various aspects of optical heterodyning are considered. Topics covered heterodyning throughout the electromagnetic spectrum including detectors, local oscillators, tunable diode lasers, astronomical systems, and environmental sensors, with both active and passive systems represented. For individual titles, see N80-29653 through N80-29671.

N80-29653*# Columbia Univ., New York. Columbia Radiation Lab.
THE PHYSICS OF HETERODYNE DETECTION IN THE FAR-INFRARED: TRANSITION FROM ELECTRIC-FIELD TO PHOTON-ABSORPTION DETECTION IN A SIMPLE SYSTEM
Melvin Carl Teich *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 1-10 refs (For primary document see N80-29652 20-36)
(Contract DAAG29-79-C-0079)
Avail: NTIS HC A12/MF A01 CSCL 20E

The history of heterodyne detection is reviewed from the radiowave to the optical regions of the electromagnetic spectrum with emphasion the submillimeter/far infrared. The transition from electric field to photon absorption detection in a simple system is investigated. The response of an isolated two level detector to a coherent source of incident radiation is calculated for both heterodyne and video detection. When the processes of photon absorption and photon emission cannot be distinguished, the relative detected power at double- and sum-frequencies is found to be multiplied by a coefficient, which is less than or equal to unity, and which depends on the incident photon energy and on the effective temperature of the system.
J.M.S.

N80-29654*# California Univ., Berkeley. Dept. of Physics.
INFRARED HETERODYNE SPECTROSCOPY IN ASTRONOMY
Albert Betz *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 11-22 refs (For primary document see N80-29652 20-36)
(Grant NGR 05-003-452)
Avail: NTIS HC A12/MF A01 CSCL 20E

A heterodyne spectrometer was constructed and applied to problems in infrared astronomical spectroscopy. The instrument offers distinct observational advantages for the detection and analysis of individual spectral lines at Doppler-limited resolution. Observations of carbon dioxide in planetary atmospheres and ammonia in circumstellar environments demonstrate the substantial role that infrared heterodyne techniques will play in the astronomical spectroscopy of the future.
J.M.S.

N80-29655*# Massachusetts Inst. of Tech., Cambridge. Department of Electrical Engineering and Computer Science.
NEW PbSnTe HETEROJUNCTION LASER DIODE STRUCTURES WITH IMPROVED PERFORMANCE
C. G. Fonstad, D. Kasemset, H. H. Hsieh, and S. Rotter *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 23-32 refs (For primary document see N80-29652 20-36)
(Grants NSG-1413; NSF DMR-76-80895)
Avail: NTIS HC A12/MF A01 CSCL 20E

Several recent advances in the state-of-the-art of lead tin telluride double heterojunction laser diodes are summarized. Continuous Wave operation to 120 K and pulsed operation to 166 K with single, lowest order transverse mode emission to in excess of four times threshold at 80 K were achieved in buried stripe lasers fabricated by liquid phase epitaxy in the lattice-matched system, lead-tin telluride-lead telluride selenide. At the same time, liquid phase epitaxy was used to produce PbSnTe distributed feedback lasers with much broader continuous single mode tuning ranges than are available from Fabry-Perot lasers. The physics and philosophy behind these advances is as important as the structures and performance of the specific devices embodying the advances, particularly since structures are continually being evolved and the performance continues to be improved.
J.M.S.

N80-29656*# General Motors Research Labs., Warren, Mich.
ADVANCES IN TUNABLE DIODE LASER TECHNOLOGY
Wayne Lo *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 33-44 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

The improvement of long-term reliability, the purification of mode properties, and the achievement of higher-temperature operation were examined. In reliability studies a slow increase in contact resistance during room temperature storage for lasers fabricated with In-Au or In-Pt contacts was observed. This increase is actually caused by the diffusion of In into the surface layer of laser crystals. By using a three layered structure of In-Au-Pt or In-Pt-Au, this mode of degradation was reduced. In characterizing the mode properties, it was found that the lasers emit in a highly localized, filamentary manner. For widestripe lasers the emission occurs near the corners of the junction. In order to achieve single-mode operation, stripe widths on the order of 8-10 micrometers are needed. Also, it was found that room temperature electroluminescence is possible near 4.6 micrometers.
J.M.S.

N80-29657*# Fujitsu Labs. Ltd., Tokyo (Japan). Kansai Research Center.
LONG WAVELENGTH PbSnTe LASERS WITH CW OPERATION ABOVE 77 K
Koji Shinohara, Mitsuo Yoshikawa, Michiharu Ito, and Ryuiti Ueda *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 45-54 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

Lead tin telluride diode lasers with emission wavelengths of 6 to 9 micrometers easily operate continuously at temperatures above 77K. These lasers have the Pb(1-y) Sn(y) TE/Pb(1-y) Te/Pb(1-y) Sn(y) Te/PbTe (substrate), (x > y) double heterostructure. To prepare this structure by LPE, the growth temperature must be below 600 C to suppress diffusion of the tin during the epitaxial growth. When the heterojunctions are formed by the usual LPE method, the junction boundaries become irregular in the case for the lasers with wavelengths of over 10 micrometers at 77K. The mechanism by which the heterojunction boundaries become irregular is cleared and a new LPE method which prevents the irregularity is explained. The lasers prepared from the wafers

grown by the new method have demonstrated CW operation at wavelengths longer than 10 micrometers above liquid nitrogen temperature. J.M.S.

N80-29658*# Perkin-Elmer Corp., Norwalk, Conn.
WIDELY TUNABLE (PbSn)Te LASERS USING ETCHED CAVITIES FOR MASS PRODUCTION
Matthew D. Miller *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 55-61 refs (For primary document see N80-29652 20-36)
(Contract NAS1-14996)
Avail: NTIS HC A12/MF A01 CSCL 20E

Lead salt diode lasers are being used increasingly as tunable sources of monochromatic infrared radiation in a variety of spectroscopic systems. These devices are particularly useful, both in the laboratory and in the field, because of their high spectral brightness (compared to thermal sources) and wide spectral coverage (compared to line-tunable gas lasers). While the primary commercial application of these lasers has been for ultrahigh resolution laboratory spectroscopy, there are numerous systems applications, including laser absorbtion pollution monitors and laser heterodyne radiometers, for which diode lasers have great potential utility. Problem areas related to the wider use of these components are identified. Among these are total tuning range, mode control, and high fabrication cost. A fabrication technique which specifically addresses the problems of tuning range and cost, and which also has potential application for mode control, is reported. J.M.S.

N80-29659*# Laser Analytics, Inc., Lexington, Mass.
RELIABILITY IMPROVEMENTS IN TUNABLE Pb1-xSnxSe DIODE LASERS
Kurt J. Linden, Jack F. Butler, Kenneth W. Nill, and Robert E. Reeder *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 63-78 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

Recent developments in the technology of Pb-salt diode lasers which have led to significant improvements in reliability and lifetime, and to improved operation at very long wavelengths are described. A combination of packaging and contacting-metallurgy improvements has led to diode lasers that are stable both in terms of temperature cycling and shelf-storage time. Lasers cycled over 500 times between 77 K and 300 K have exhibited no measurable changes in either electrical contact resistance or threshold current. Utilizing metallurgical contacting process, both lasers and experimental n-type and p-type bulk materials are shown to have electrical contact resistance values that are stable for shelf storage periods well in excess of one year. Problems and experiments which have led to devices with improved performance stability are discussed. Stable device configurations achieved for material compositions yielding lasers which operate continuously at wavelengths as long as 30.3 micrometers are described. J.M.S.

N80-29660*# Lockheed Missiles and Space Co., Palo Alto, Calif.
***LONG WAVELENGTH Pb(1-X)Sn(X)Se AND Pb(1-x)Sn(X)Te* DIODE LASERS AS LOCAL OSCILLATORS**
E. R. Washwell *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 79-95 refs (For primary document see N80-29652 20-36)
(Contract DASG60-76-C-0061)
Avail: NTIS HC A12/MF A01 CSCL 20E

A breadboard heterodyne receiver is described which was used to establish the characteristics of lead salt diode lasers pertinent to their use as local oscillators using laser devices operating in the 15-25 micrometer spectral region. Heterodyne detection efficiency is directly correlated with the transverse mode structure and emphasizes the necessity of stable lowest order mode operation for lasers when used as local oscillators. The results obtained indicate that the continued development of these lasers provide suitable local oscillators for a variety of applications. J.M.S.

N80-29661*# Perkin-Elmer Corp., Norwalk, Conn.
***DIAGNOSTICS AND CONTROL OF WAVENUMBER STABILITY AND PURITY OF TUNABLE DIODE LASERS* RELEVANT TO THEIR USE AS LOCAL OSCILLATORS IN HETERODYNE SYSTEMS**
S. Poultney, D. Chen, G. Steinberg, F. Wu, A. Pines, M. D. Miller, and M. McNally *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 97-128 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

Initial operation of the tunable diode lasers (TDL) showed that it was not possible to adjust the wavenumber to one selected a priori in the TDL tuning range. During operation, the operating point would change by 0.1/cm over the longer term with even larger changes occurring during some thermal cycles. Most changes during thermal cycling required using lower temperatures and higher currents to reach the former wavenumber (when it could be reached). In many cases, an operating point could be selected by changing TDL current and temperature to give both the desired wavenumber and most of the power in a single mode. The selection procedure had to be used after each thermal cycling. Wavenumber nonlinearities of about 10% over a 0.5 cm tuning range were observed. Diagnostics of the single mode selected by a grating monochromator showed wavenumber fine structure under certain operating conditions. The characteristics due to the TDL environment included short term wavenumber stability, the instrument lineshape function, and intermediate term wavenumber stability. J.M.S.

N80-29662*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
EXCESS NOISE IN Pb(1-x)Sn(X)Se SEMICONDUCTOR LASERS
Charles N. Harward and Barry D. Sidney *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 129-142 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

The noise characteristics of the TDL were studied for frequencies less than 20 kHz. For heterodyne applications, the high frequency (> 1 MHz) characteristics are also important. Therefore, the high frequency noise characteristics of the TDL were studied as a part of a full TDL characterization program which has been implemented for the improvement of the TDL as a local oscillator in the LHS system. It was observed that all the devices showed similar high frequency noise characteristics even though they were all constructed using different techniques. These common high frequency noise characteristics are reported. J.M.S.

N80-29663*# Airborne Instruments Lab., Melville, N. Y. AIL Div.
FINE WAVELENGTH ID FOR TUNABLE LASER LOCAL OSCILLATORS
M. G. Savage and R. C. Augeri *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 143-152 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20E

A wavelength ID device which consists of an electronic show that the etalon has a finesse F > 30 which is maintainable for several days. These tests also demonstrate that the etalon system is capable of resonance frequency stability during similar time periods. With currently available coatings, this level of performance is achievable over an optical bandwidth delta lambda = 3 micrometers centered at lambda = 10 micrometers. J.M.S.

N80-29664*# National Aeronautics and Space Administration, Washington, D. C.
***A REVIEW OF THE NASA/OAST CRYOGENIC COOLERS* TECHNOLOGY PROGRAM**
J. G. Lundholm, Jr. and Allan Sherman (NASA. Goddard Space Flight Center, Greenbelt, Md.) *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 153-170 refs (For primary document see N80-29652 20-36)
Avail: NTIS HC A12/MF A01 CSCL 20L

Low and ultra low temperature cryogenic cooler systems for future space missions include mechanical, solid cryogen, gas adsorption, superfluid helium, helium-3, and magnetic (adiabatic demagnetization) coolers. Operating lifetimes required vary from a few weeks for a Shuttle/Spacelab mission to as long as nine years for missions to the outer planets. Temperature requirements

vary from tens to tenths of kelvin. At the higher temperature, cooling loads for detectors, instruments and associated shields may be as high as 15 watts. The general requirements for low and ultra low temperature and techniques that can be employed to achieve these temperatures at expected heat loads are discussed. The NASA Centers involved in the R & T efforts and the type of cooler systems on which they are focusing their effort are considered as well as the thrust of R & T effort for each cooler type. Projected missions that will use the technology are identified. A.R.H.

N80-29665*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ATMOSPHERIC STUDIES AND APPLICATIONS WITH INFRARED HETERODYNE DETECTION TECHNIQUES

Robert T. Menzies In NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 171-179 refs (For primary document see N80-29652 20-36)

Avail: NTIS HC A12/MF A01 CSCL 20E

With the advent of stable, cw infrared lasers with moderate output power capabilities in the mid 1960's came the idea of using heterodyne detection, a mature radio frequency technique, in the infrared. This technique was first applied in radar and communications applications; however, it became apparent that infrared lasers and heterodyne detection techniques would be useful in a number of atmospheric measurement applications. The level to which these techniques are being put to use in field measurements is shown using two developed flight instruments as examples. J.M.S.

N80-29666*# Airborne Instruments Lab., Melville, N. Y.

INFRARED HETERODYNE RADIOMETER FOR AIRBORNE ATMOSPHERIC TRANSMITTANCE MEASUREMENTS

J. M. Wolczok, R. A. Lange, and A. J. DiNardo *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 *Aug. 1980 p 181-197 refs* (For primary document see N80-29652 20-36)

(Contract F29601-78-C-0045)

Avail: NTIS HC A12/MF A01 CSCL 20E

An infrared heterodyne radiometer (IHR) was used to measure atmospheric transmittance at selected hydrogen fluoride (2.7 micrometer) and deuterium fluoride (3.8 micrometer) laser transitions. The IHR was installed aboard a KC-135 aircraft for an airborne atmospheric measurements program that used the sun as a backlighting source for the transmission measurements. The critical components are: a wideband indium antimonide (InSb) photomixer, a CW HF/DF laser LO, a radiometric processor, and a 1900 K blackbody reference source. The measured heterodyne receiver sensitivity (NEP) is 1.3 x 10 to the -19th power W/Hz, which yields a calculated IHR temperature resolution accuracy of delta I sub S/-3 sub S = 0.005 for a source temperature of 1000 K and a total transmittance of 0.5. Measured atmospheric transmittance at several wavelengths and aircraft altitudes from 9.14 km (30,000 ft) to 13.72 km (45,000 ft) were obtained during the measurements program and have been compared with values predicted by the AFGL Atmospheric Line Parameter Compilation. J.M.S.

N80-29667*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

***DEVELOPMENT AND PERFORMANCE OF A LASER* HETERODYNE SPECTROMETER USING TUNABLE SEMICONDUCTOR LASERS AS LOCAL OSCILLATORS**

D. Glenar (Pennsylvania State Univ., University Park), T. Kostiuk, D. E. Jennings, and M. J. Mumma *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 199-208 refs (For primary document see N80-29652 20-36)

Avail: NTIS HC A12/MF A01 CSCL 20E

A diode laser based IR heterodyne spectrometer for laboratory and field use was developed for high efficiency operation between 7.5 and 9.5 microns. The local oscillator is a PbSSe tunable diode laser kept continuously at operating temperatures of 12-60 K using a closed cycle cooler. The laser output frequency is controlled and stabilized using a high precision diode current supply, constant temperature controller, and a shock isolator mounted between the refrigerator cold tip and the diode mount. Single laser modes are selected by a grating placed in the local oscillator beam. The system employs reflecting optics throughout to minimize losses from internal reflection and absorption, and to eliminate chromatic effects. Spectral analysis of the diode laser output between 0 and 1 GHz reveals excess noise at many diode current settings, which limits the infrared spectral regions over which useful heterodyne operation can be achieved. System performance has been studied by making heterodyne measurements of etalon fringes and several Freon 13 (CF_3Cl) absorption lines against a laboratory blackbody source. Preliminary field tests have also been performed using the Sun as a source. Author

N80-29668*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ATMOSPHERIC SOLAR ABSORPTION MEASUREMENTS IN THE 9-11 MICRON REGION USING A DIODE LASER HETERODYNE SPECTROMETER

Charles N. Harward (Old Dominion Univ., Norfolk, Va.) and James M. Hoell, Jr. *In its Heterodyne Systems and Technol., Pt. 1* Aug. 1980 p 209-220 *refs* (For primary document see N80-29652 20-36)

Avail: NTIS HC A12/MF A01 CSCL 20E

A tunable diode laser heterodyne radiometer was developed for ground based measurements of atmospheric solar absorption spectra in the 9 to 12 micron spectral range. The performance and operating characteristics of this tunable infrared heterodyne radiometer (TIHR) is discussed along with recently measured heterodyne solar absorption spectra in the 10 to 11 micron spectral region. J.M.S.

N80-29669*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

***SENSITIVITY STUDIES AND LABORATORY MEASUREMENTS* FOR THE LASER HETERODYNE SPECTROMETER EXPERIMENT**

Frank Allario, Stephen J. Katzberg, and Jack C. Larsen (Systems and Applied Science Corp.) *In its* Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 221-239 *refs* (For primary document see N80-29652 20-36)

Avail: NTIS HC A12/MF A01 CSCL 20E

Several experiments involving spectral scanning interferometers and gas filter correlation radiometers (ref. 2) using limb scanning solar occultation techniques under development for measurements of stratospheric trace gases from Spacelab and satellite platforms are described. An experiment to measure stratospheric trace constituents by Laser Heterodyne Spectroscopy, a summary of sensitivity analyses, and supporting laboratory measurements are presented for O3, ClO, and H_2O_2 in which the instrument transfer function is modeled using a detailed optical receiver design. J.M.S.

N80-29670*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A 163 MICRON LASER HETERODYNE RADIOMETER FOR OH Progress Report

H. M. Pickett and T. L. Boyd *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 241-248 refs (For primary document see N80-29652 20-36)

Avail: NTIS HC A12/MF A01 CSCL 20E

A 163 micron (1.836 THz) radiometer developed for airplane and/or balloon platforms is described. The laser local oscillator is a CO2 pumped methanol laser operating at a frequency which is approx. 1 GHz from the J = 3/2 - 1/2 transition of OH. The laser is used directly as a local oscillator or is translated in frequency to closer coincidence with the OH emission, depending on achieved detector IF bandwidth. Frequency translation techniques which are described are diode mixing and a method of single sideband generation using an external Stark modulated gas cell. The photoconductive mixer used is a strained Ge crystal, doped with Ga, originally used as an incoherent detector. The uniaxial strain on the Ga doped Ge crystal shifts the threshhold for photoconduction from 100/cm to frequencies as low as 50/cm. These detectors are currently being characterized as mixers in the laboratory. Of particular interest are the effect of local oscillator power and strain on IF, bandwidth detector impedance, and conversion loss. Preliminary results of these tests are described and compared with theoretical expectations. J.M.S.

N80-29671*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

HETERODYNE DETECTION OF THE 752.033-GHz H2O ROTATIONAL ABSORPTION LINE

G. F. Dionne, J. F. Fitzgerald, T-S. Chang, M. M. Litvak, and H. R. Fetterman *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 1 Aug. 1980 p 249-262 refs Sponsored by Army Prepared in cooperation with Lincoln Lab., MIT, Lexington (For primary document see N80-29652 20-36)

Avail: NTIS HC A12/MF A01 CSCL 20E

A tunable high resolution two stage heterodyne radiometer was developed for the purpose of investigating the intensity and lineshape of the 752.033 GHz rotational transition of water vapor. Single-sideband system noise temperatures of approximately 45,000 K were obtained using a sensitive GaAs Schottky diode as the first stage mixer. First local oscillator power was supplied by a CO2 laser pumped formic acid laser (761.61 GHz), generating an X-band IF signal with theoretical line center at 9.5744 GHz. Second local oscillator power was provided by means of a 3 GHz waveguide cavity filter with only 9 dB insertion loss. In absorption measurements of the H2O taken from a laboratory simulation of a high altitude rocket plume, the center frequency of the 752 GHz line was determined to within 1 MHz of the reported value. A rotational temperature 75 K, a linewidth 5 MHz and a Doppler shift 3 MHz were measured with the line-of-sight intersecting the simulated-plume axis at a distance downstream of 30 nozzle diameters. These absorption data were obtained against continuum background radiation sources at temperatures of 1175 and 300 K. J.M.S.

N80-29672*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HETERODYNE SYSTEMS AND TECHNOLOGY, PART 2

Aug. 1980 321 p refs Conf. held in Williamsburg, Va., 25-27 Mar. 1980

(NASA-CP-2138-Pt-2; L-13849) *Avail: NTIS* HC A14/MF A01 CSCL 20E

Various aspects of optical heterodyning are covered including active and passive systems, local oscillators, tunable diode lasers, detectors and related systems. For individual titles, see N80-29673 through N80-29693.

N80-29673*# Honeywell Electro-Optics Center, Lexington, Mass.

SOME n-p (Hg,Cd)Te PHOTODIODES FOR 8-14 MICROMETER HETERODYNE APPLICATIONS

James F. Shanley and Chris T. Flanagan *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 263-280 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The results describing the dc and CO2 laser heterodyne characteristics of a three element photodiode array and single element and four element photodiode arrays are presented. The measured data shows that the n(+)-p configuration is capable of achieving bandwidths of 475 to 725 MHz and noise equivalent powers of 3.2 x 10 to the minus 20th power W/Hz at 77 K and 1.0 x 10 to the minus 19th power W/Hz at 145 K. The n(+)-n(-)-p photodiodes exhibited wide bandwidths (approximately 2.0 GHz) and fairly good effective heterodyne quantum efficiencies (approximately 13-30 percent at 2.0 GHz). Noise equivalent powers ranging from 1.44 x 10 to the minus 19th power W/Hz to 6.23 x 10 to the minus 20th power W/Hz were measured at 2.0 GHz. R.C.T.

N80-29674*# Societe Anonyme de Telecommunications, Paris (France).

CONCEPTUAL DESIGN AND APPLICATIONS OF HgCdTe INFRARED PHOTODIODES FOR HETERODYNE SYSTEMS

Michel B. Sirieix and Henry Hofheimer (ELTEK Corp., Larchmont, N.Y.) In NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 281-295 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The significance of HgCdTe photodiodes are discussed relative to their existance in heterodyne detection systems operating in the 9 to 11 micrometer CO2 laser wavelength region. Their successful fabrication as well as the physical properties of the materials are described. The implementation of controlled industrial processes are reported with emphasis on the yield of predictable and repeatable detector characteristics to the discriminating systems, demands for high cutoff frequencies, quantum efficiency, and reliability. The most salient production steps and diode characteristics are presented. Measured results from production units are also given. R.C.T.

N80-29675*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPARATIVE PERFORMANCE OF HgCdTe PHOTODIODES FOR HETERODYNE APPLICATION

Herbert R. Kowitz *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 297-308 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The use of photodiodes as optical photomixers in laser heterodyne spectroscopy systems is discussed. The quantum efficiency of the photodiodes is reported with the emphasis on its effect on the system's signal to noise ratio. The measurement techniques used to determine photodiode dc and heterodyne quantum efficiencies are described. The theory behind the measurements as well as actual measurements data for two HgCdTe photodiodes are presented. R.C.T.

N80-29676*# Lincoln Lab., Mass. Inst. of Tech., Lexington.

EXTENDING THE OPERATING TEMPERATURE, WAVELENGTH AND FREQUENCY RESPONSE OF HgCdTe HETERODYNE DETECTORS

David L. Spears *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 309-325 refs Sponsored in part by DARPA and AF (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Near ideal optical heterodyne performance was obtained at GHz IF frequencies in the 10 micrometer wavelength region with liquid nitrogen cooled HgCdTe photodiodes. Heterodyne NEP's as low as 2.7 x 10 to the minus 20th power W/Hz at 100 MHz, 5.4 x 10 to the minus 20th power W/Hz at 1.5 GHz, and 9.4 x 19 to the minus 20th power W/Hz at 3 GHz were achieved. Various physical phenomena which occur within a photodiode and affect heterodyne operation were examined in order to assess the feasibility of extending the operating temperature, wavelength, and frequency response of these HgCdTe photomixers. R.C.T.

N80-29677*# Airborne Instruments Lab., Melville, N. Y.

INFRARED HETERODYNE RECEIVERS WITH IF RESPONSES APPROACHING 5 GHz

J. M. Wolczok and Bud J. Peyton *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 327-340 refs Sponsored by DOE (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Specialized coherent 10.6 micrometer infrared receivers were developed with infrared frequency responses approaching 5 GHz. Carbon dioxide lasers were employed for these applications because of their availability, stability, and high average power levels. Heterodyne receivers which employ extrinsic photoconductive Ge:Cu(Sb) mixers were developed for measurements of carbon dioxide laser scattering to determine: (1) the drive lower hybrid wave density fluctuations; and (2) the plasma ion temperature of the dense Tokamak plasmas. R.C.T.

N80-29678*# Lincoln Lab., Mass. Inst. of Tech., Lexington.

FAR INFRARED HETERODYNE SYSTEMS

Peter E. Tannenwald *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 341-352 refs Sponsored in part by Army and AF (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Three far infrared detectors, the InSb hot electron bolometer, the GaAs Schottky diode and the Josephson point contact junction, were incorporated as mixers into sensitive heterodyne systems. The performances of existing heterodyne receivers/radiometers using these detectors are described and compared. Other applications of submillimeter heterodyne techniques are discussed. R.C.T.

N80-29679*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

BULK SUBMILLIMETER-WAVE MIXERS: STRAIN AND SUPERLATTICES

Marvin M. Litvak and Herbert M. Pickett *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 353-363 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Strained germanium crystals, doped with gallium, were used as heterodyne mixers at THz frequencies, with infrared bandwidths approaching a GHz. The mixer performance (conversion loss and mixer noise) was analyzed in terms of nonlinearities associated with acceptor levels and with relaxation rates of free holes. Comparison was made with similar mixers employing low lying donor levels in high purity GaAs and with hot electron InSb mixers. R.C.T.

N80-29680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OPTICAL CONSIDERATIONS IN INFRARED HETERODYNE SPECTROMETER DESIGN

T. Kostiuk, Michael J. Mumma, and D. Zipoy (Maryland Univ., College Park) *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 365-372 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The optical design considerations for optimization of sensitivity, tunability, and versatility of an infrared heterodyne spectrometer are discussed using the GSFC CO2 laser heterodyne spectrometer optical front end as an example. Problems related to the coherent nature of the laser local oscillator beam (e.g., interference effects at edges of optical elements and at the beam combining beamsplitter) are described and proper beamsplitter design discussed. Optimum matching to the telescope is discussed. The severe effects of large central obscuration on the coherent telescope efficiency are described and steps to partially recover the lost system sensitivity are proposed. Measurements made with the GSFC 48 inch telescope (linear obscuration rate ~ 0.5) and the KPNO McMathe telescope (no obscuration) are given as examples. J.M.S.

N80-29681*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RF SPECTROMETERS FOR HETERODYNE RECEIVERS

David Buhl and Michael J. Mumma *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 373-383 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Several types of spectrometers developed for radio astronomy receivers which utilize RF filters, multiple oscillators and mixers, digital autocorrelators and acoustic/optic devices are considered. The RF spectrometer developed at GSFC to provide wide bandwidths (greater than 1 GHz) as well as high resolution (5 MHz) is described. The 128 channel filter bank is divided into high and low resolution sections. The high resolution section is tunable by providing a second mixer ahead of the filter bank. This is necessary because infrared receivers which use gas lasers as local oscillators are only tunable to specific laser frequencies. To compensate for astronomical Doppler shifts and molecule frequency differences a second local oscillator and mixer is needed. A diagram of the RF section of the filter bank is shown. The RF spectrometer is shown to be the best means of achieving ultra-wide bandwidths for infrared heterodyne receivers. For high resolution with a large number of channels, the acousto/optical spectrometer is the principle instrument, particularly for balloon or space flight applications. J.M.S.

N80-29682*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ACOUSTO-OPTIC SPECTROMETER FOR RADIO ASTRONOMY

Gordon Chin, David Buhl, and Jose M. Florez *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 385-397 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

A prototype acousto-optic spectrometer which uses a discrete bulk acoustic wave Itek Bragg cell, 5 mW Helium Neon laser, and a 1024 element Reticon charge coupled photodiode array is described. The analog signals from the photodiode array are digitized, added, and stored in a very high speed custom built multiplexer board which allows synchronous detection of weak signals to be performed. The experiment is controlled and the data are displayed and stored with an LSI-2 microcomputer system with dual floppy discs. The performance of the prototype acousto-optic spectrometer obtained from initial tests is reported. J.M.S.

N80-29683*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MICROWAVE TUNABLE LASER SOURCE: A STABLE, PRECISION TUNABLE HETERODYNE LOCAL OSCILLATOR

Glen W. Sachse *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 399-415 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The development and capabilities of a tunable laser source utilizing a wideband electro-optic modulator and a CO2 laser are described. The precision tunability and high stability of the device are demonstrated with examples of laboratory spectroscopy. Heterodyne measurements are also presented to demonstrate the performance of the laser source as a heterodyne local oscillator. With the use of five CO2 isotope lasers and the 8 to 18 GHz sideband offset tunability of the modulator, calculations indicate that > 50 percent spectral coverage in the 9 to 12 micron region is achievable. The wavelength accuracy and stability of this laser source is limited by the CO2 laser and is more than adequate for the measurement of narrow Doppler-broadened line profiles. The room-temperature operating capability and the programmability of the microwave tunable laser source are attractive features for its in-the-field implementation. Although heterodyne measurements indicated some S/N degradation when using the device as a local oscillator, there does not appear to be any fundamental limitation to the heterodyne efficiency of this laser source. Through the use of a lower noise-figure traveling wave tube amplifier and optical matching of the output beam with the photomixer, a substantial increase in the heterodyne S/N is expected. M.G.

N80-29684*# Aerospace Corp., Los Angeles, Calif. Electronics Research Lab.

SUBMILLIMETER LOCAL OSCILLATORS FOR HETERODYNE SPECTROSCOPY

Edward J. Danielewicz, Jr. *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 417-447 refs Sponsored by DOE (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The major technological innovations in continuous wave (CW) submillimeter sources which are specifically suitable for application as local oscillators in heterodyne systems are reviewed. A description of the various sources is given which underscores the general principles and operating features for each type of device. Particular emphasis is placed on CW optically pumped lasers, which have had a dramatic impact as widely available sources of narrow linewidth coherent radiation. The state-of-the-art is summarized for these lasers and performance data are presented for several local oscillator packages. Optically pumped lasers are then compared and contrasted with other competing sources such as backward wave oscillators, IMPATT diodes, and Josephson junctions. By comparing their advantages and limitations for use as local oscillators, the potential applications of these different sources are projected. The prospects for increased tunability, reliability, and scalability are briefly considered, and several novel techniques for generating partially tunable radiation using Schottky diode mixers or CW Raman lasers are highlighted. M.G.

N80-29685*# Phoenix Corp., McLean, Va.

SUB mm LASER LOCAL OSCILLATORS: DESIGN CRITERIA AND RESULTS

Gerhard A. Koepf *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 449-460 refs (For primary document see N80-29672 20-36)

(Contract NAS5-26030)

Avail: NTIS HC A14/MF A01 CSCL 20E

Diagnostic results are given of the spectral features and the power conversion efficiency of submillimeter (SMM) laser local oscillators. Several criteria are obtained for the design of frequency stable and efficient smm lasers for local oscillator applications. Finally, a design is described and results on the power output and power and frequency stability are given. The mode pattern is very close to a Gaussian profile so that efficient coupling to a quasioptical mixer is possible. The laser provides sufficient output power at a large number of lines to drive the mixer into the low conversion loss regime. Radiometric integration times of several minutes with a spectral resolution of 1 MHz will be possible. With present state-of-the-art Schottky mixers and low noise preamplifiers a radiometric temperature resolution of a few K can be expected over a spectral range from 500 to 900 GHz. M.G.

N80-29686*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DESIGN CONSIDERATIONS FOR OPTICAL HETERODYNE RECEIVERS: A REVIEW

John J. Degnan *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 461-486 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The current state of knowledge concerning optical heterodyne receivers is reviewed. Following a discussion of noise processes in the heterodyne receiver and the manner in which sensitivity is increased through time integration of the detected signal, an expression for the mean square signal current is derived by mixing a coherent local oscillator with a partially coherent, quasimonochromatic source. Then the manner in which the IF signal calculation can be transferred to any convenient plane in the optical front end of the receiver is demonstrated. Using these techniques, a relatively simple equation is obtained for the coherently detected signal from an extended incoherent source and applied to the heterodyne detection of an extended thermal source and to the backscatter lidar problem where the antenna patterns of both the transmitter beam and heterodyne receiver must be taken into account. Finally, the detection of a coherent source is considered and, in particular, a distant point source such as a star or laser transmitter in a long range heterodyne communications system is discussed. M.G.

N80-29687*# Hughes Aircraft Co., Culver City, Calif.

MIXING EFFICIENCY IN HETERODYNE SYSTEMS

David Fink *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 487-494 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

How the spatial distributions of the signal and local oscillator fields affect the heterodyne signal to noise ratio is examined for both a single detector and an array of detectors. For an array, the distribution of gain among the intermediate frequency (i.f.) amplifiers is included. The emphasis is on understanding why the distributions are important and what is the key to maximizing the signal to noise ratio in any system. It is shown that for a single detector, the highest signal to noise ratio is obtained with a local oscillator (LO) distribution the same as that of the signal. For an array, the product of the i.f. gain times the LO field at each detector has the same distribution as that of the signal field. M.G.

N80-29688*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPATIAL FREQUENCY RESPONSE OF AN OPTICAL HETERODYNE RECEIVER

Carl L. Fales and Don M. Robinson *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 495-510 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The principles of transfer function analysis are applied to a passive optical heterodyne receiver to obtain the modulation transfer function (MTF). MTF calculations are performed based on an optical platform which is imaging vertically varying profiles at worst case shuttle orbit altitudes. An analysis of the derogatory effects of sampling (aliasing) and central obscurations on both resolution and heterodyne efficiency is given. It is found that the cascading property of MTF analysis must be carefully applied since the coherent transfer function of the optical receiver and that due to the local oscillator-detector combination are not separable but are related by the convolution of their products. Application of these results to the specific case of a space-lab type optical heterodyne receiver shows that resolutions of the order of 1.5-2.0 Km are possible for worst-case type orbital scenarios. Further, comparison of obscured-type receivers (e.g., Cassegrains) with unobscured receivers shows that both resolution and efficiency are severely degraded in an obscured-type receiver and consequently should not be used for a passive heterodyne detection scheme. M.G.

N80-29689*# Laser Development Corp., Lexington, Mass.

HIGH PRESSURE GAS LASER TECHNOLOGY FOR ATMOSPHERIC REMOTE SENSING

Ali Javan (MIT, Cambridge) *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 511-528 refs Sponsored in part by NSF (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

The development of a fixed frequency chirp-free and highly stable intense pulsed laser made for Doppler wind velocity measurements with accurate ranging is described. Energy extraction from a high pressure CO2 laser at a tunable single mode frequency is also examined. M.G.

N80-29690*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN AIRBORNE DOPPLER LIDAR

Charles A. DiMarzio *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 529-540 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

A pulsed CO2 Doppler Lidar, developed for airborne measurements of atmospheric wind fields, is described. In-flight tests show that the device can be successfully utilized in the detection and measurement of mountain-wave turbulence and wind shear, and in the generation of time histories of wind-field variations in smooth flight. This Lidar is in the process of being configured for measurement of the atmospheric flow fields surrounding severe convective storms. M.G.

N80-29691*# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SURFACE RELIEF STRUCTURES FOR MULTIPLE BEAM LO GENERATION

Wilfrid B. Veldkamp *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 541-556 refs Sponsored by the AF (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

Linear and binary holograms for use in heterodyne detection with 10.6 micron imaging arrays are described. The devices match the amplitude and phase of the local oscillator to the received signal and thus maximize the system signal to noise ratio and resolution and minimize heat generation on the focal plane. In both the linear and binary approaches, the holographic surface-relief pattern is coded to generate a set of local oscillator beams when the relief pattern is illuminated by a single planewave. Each beam of this set has the same amplitude shape distribution as, and is collinear with, each single element wavefront illuminating array. M.G.

N80-29692*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DIAL WITH HETERODYNE DETECTION INCLUDING SPECKLE NOISE: AIRCRAFT/SHUTTLE MEASUREMENTS OF O3, H2O, AND NH3 WITH PULSED TUNABLE CO2 LASERS

Philip Brockman, Robert V. Hess, Leo D. Staton, and Clayton H. Bair *In its* Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 557-567 refs (For primary document see N80-29672 20-36)

Avail: NTIS HC A14/MF A01 CSCL 20E

A parametric analysis of DIAL sensitivity with heterodyne detection is presented and comparisons with direct detection are discussed. Examples are given for monitoring vertical distributions of O3, H2O, and NH3 using a ground-, aircraft-, or shuttle-based pulsed tunable CO2 laser DIAL system. Results

indicate that maximum sensitivity at minimum laser energy per measurement requires multiple pulse operation with the energy per pulse selected so that the measured photon rate is approximately equal to the detector IF bandwidth. Measurement sensitivities can be maximized and interference effects minimized by fine adjustment of measurement frequencies using the tunability of high pressure lasers. The use of rare isotope lasers minimizes loss due to CO2 atmospheric absorption. M.G.

N80-29693*# Youngstown State Univ., Ohio.
HETERODYNE SIGNAL-TO-NOISE RATIOS IN ACOUSTIC MODE SCATTERING EXPERIMENTS
William R. Cochran *In* NASA. Langley Res. Center Heterodyne Systems and Technol., Pt. 2 Aug. 1980 p 569-572 refs (For primary document see N80-29672 20-36)
Avail: NTIS HC A14/MF A01 CSCL 20E

The relation between the signal to noise ratio (SNR) obtained in heterodyne detection of radiation scattered from acoustic modes in crystalline solids and the scattered spectral density function is studied. It is shown that in addition to the information provided by the measured frequency shifts and line widths, measurement of the SNR provides a determination of the absolute elasto-optical (Pockal's) constants. Examples are given for cubic crystals, and acceptable SNR values are obtained for scattering from thermally excited phonons at 10.6 microns, with no external perturbation of the sample necessary. The results indicate the special advantages of the method for the study of semiconductors. M.G.

N80-29694# Committee on Commerce, Science, and Transportation (U. S. Senate).
LASER TECHNOLOGY: DEVELOPMENT AND APPLICATIONS
Washington GPO 1980 273 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 1st and 2nd Sess., 12 and 14 Dec. 1979, 8 and 12 Jan. 1980
(GPO-59-826) Avail: Subcommittee on Science, Technology and Space

An overview of developments and applications in laser technology is given with emphasis on peaceful uses of high energy laser technology. Space vehicle propulsion, remote sensing from space to monitor the Earth's atmosphere, oceans, and land masses, communications with very high data rates over interplanetary distances, and isotope separation and fusion to improve generation of electrical power are among the topics discussed. Potential military applications of high energy lasers weapons discussed include instaneous kill of hostile targets, such as ballistic missiles, and strategic bombers. J.M.S.

N80-29695# Avco-Everett Research Lab., Mass.
EXCIMER LASER RESEARCH Quarterly Report, 16 Nov. 1978 - 15 Feb. 1979
J. H. Parks 15 Feb. 1979 42 p refs
(Contract N00014-75-C-0063; DARPA Order 1806)
(AD-A085519) Avail: NTIS HC A03/MF A01 CSCL 20/5

This quarterly report describes experimental investigations of interhalogen molecules. These molecules are under consideration to achieve high power scalable laser action in the near UV and visible portion of the spectrum. The report includes a description of fluorescence experiments for these molecules and an analysis of formation kinetics. A theoretical model has been developed to describe the excited ion-pair state structure of the interhalogens. The predictions of this theory are borne out by fluorescence experiments. GRA

N80-29696# Avco-Everett Research Lab., Mass.
EXCIMER LASER RESEARCH Final Technical Report, 15 Aug. 1974 - 29 Sep. 1979
J. H. Parks 1979 150 p refs
(Contract N00014-75-C-0063; DARPA Order 1806)
(AD-A085520) Avail: NTIS HC A07/MF A01 CSCL 20/5

This final report describes theoretical and experimental investigations of the rare gas monohalides, halogens, mercury monohalides and interhalogen molecules. These molecules show great promise for achieving high power scalable laser action in the near UV and visible portion of the spectrum. The report includes a description of fluorescence and lasing experiments for these molecules; an analysis of formation kinetics; and theoretical calculations of rare gas metastable photoionization and the mercury halide radiative lifetimes. A theoretical model has been developed to describe the excited ion-pair state structure of the rare gas halides and interhalogens. The predictions of this theory are borne out by fluorescence experiments. GRA

N80-29697# New Mexico Inst. of Mining and Technology, Socorro. Geophysical Research Center.
THE CLOUD EFFECTS PHASE OF THE LASER INDUCED LIGHTNING INVESTIGATION Final Report
C. B. Moore, D. N. Holden, and James Griswold Apr. 1980 48 p refs
(Grant AF-AFOSR-3722-78; AF Proj. 2310)
(AD-A085345; AFOSR-80-0454TR) Avail: NTIS HC A03/MF A01 CSCL 04/1

A mountain-top laboratory facility has been established in central New Mexico for studies of the effects of high powered lasers on the ionization of the air and on the possible triggering of lightning from thunderclouds overhead. A net of electric field meters and another one with television cameras and video recorders have been established for determinations of the nature of normal and of triggered lightning in the operational area. A special electric field meter is carried beneath a captive balloon to heights of about 600 m above the facility and measured the electric fields there for the entire life of several storms. The field strengths aloft were as much as 6 fold greater than those observed at the surface; the field changes after lightning did not show the characteristic reversal caused by the corona produced space charge and the field after lightning recovered with a linear increase until lightning occurred again. Monitoring of electric fields aloft therefore provide a better choice of the optimum times for a lightning triggering attempt. As part of the 1979 field work, lightning discharges were induced twice by the use of wire-trailing, French rockets fired into thunderclouds over the Magdalena Mountains. As a result, interesting measurements of the breakdown process were obtained using AF Weapons Laboratory electromagnetic sensors: Magnetic field derivative signals in excess of 17 Teslas/second were observed in one of the triggered discharges. GRA

N80-29698# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Aug. 1978 - 31 Jan. 1979
A. V. Phelps and A. C. Gallagher 8 Feb. 1980 18 p refs
(Contract N00014-76-C-0123; ARPA Order 2683)
(AD-A085805) Avail: NTIS HC A02/MF A01 CSCL 20/5

Measurements have been made of the electrical and optical properties of electrical discharges in Mg-Xe mixtures at moderate current densities (50-100 A/cm to the 2nd power) and high Xe pressures (1 to 5 atmospheres). Preliminary analyses indicate a rather low electron and excitation temperature resulting from unexplained large energy losses. Efforts to obtain the high excitation temperatures required for efficient, high power excimer laser operation will continue. An experiment is being designed to provide effective rate coefficients for electron excitation and deexcitation of excited mercury atoms so as to provide data necessary for the modeling of the contribution of these states to the production of upper laser levels and to the growth of ionization and instabilities in discharge excited lasers. This experiment will use laser induced perturbation of the excited state densities and optical observation of the relaxation of excited state densities. GRA

N80-29699# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARISON OF CONTROL METHODS IN A FREQUENCY STABILIZED LASER M.S. Thesis
Robert D. Luzitano Jan. 1980 140 p refs
(AD-A085707; AFIT/GE/EE/80-2) Avail: NTIS HC A07/MF A01 CSCL 20/5

The purpose of this research is to compare two types of control methods that can be used to frequency stabilize a laser. The first method uses a single piezoelectric transducer (PZT) to control the cavity length of a helium-neon laser. The second method employs dual PZT controllers of different lengths so that a fast response time can be achieved with the benefit of a large dynamic range. Two variations of the first method are compared to the second method. The first variation uses an

integrator with gain as a compensator in electronic feedback control loop and is designed using steady state analysis. The second variation uses a more sophisticated compensator that is designed using frequency analysis. Frequency analysis is also used in the compensator design for the second method. Each compensator is tested in a laser control loop and the results of each method are compared. GRA

N80-29700# Chicago Univ., Ill.
THERMALLY PRODUCED POPULATION INVERSIONS AND THEIR CONSEQUENCES Final Report, 1 Jan. 1977 - 18 Jan. 1980
R. Stephen Berry 30 May 1980 7 p refs
(Grant DAAG29-77-G-0080)
(AD-A086072; ARO-14493.1-C) Avail: NTIS HC A02/MF A01 CSCL 20/5

Alkali halide molecules dissociated by shock waves in gases exhibit population distributions far from equilibrium. The kinetics of the subsequent chemical relaxation have been worked out and the rate coefficients have been determined for many of these ionic molecules. In some cases, the nonequilibrium populations are highly inverted, and in at least two systems, the inverted population has been used to produce light amplification (lasing action) with spectral lines in the visible region. GRA

N80-29701# AEG-Telefunken, Frankfurt am Main (West Germany). Forschungsinst.
LEAD CHALCOGENIDE DIODE LASERS Final Report
Roland Grisar, Axel Haime, Harald Matthes, Horst Preier, and Wolfgang Riedel Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 136 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-66; ISSN-0340-7608) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 34.85

An infrared diode laser emitting in the spectral range from 4 to 8 microns was developed. An attempt to increase the operational temperature by using double hetero-structures was made. The refining of diode materials, crystal growth (Pb S(1-X) Se(X) and Pb(1-X) Sn(X) Se), and the diode technology of laser structures are reported. The laser casing is described and operating tests are outlined for different cooling techniques. Successful results are shown for continuous wave operation with a liquid nitrogen cooler and for pulsed operation using a Peltier cooler. Finally, laser applications in spectroscopy are discussed.
Author (ESA)

N80-29702# National Technical Information Service, Springfield, Va.
RADIATION DAMAGE OF LASER MATERIALS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Brian Carrigan May 1980 226 p Supersedes NTIS/PS-79/0514; NTIS/PS-78/0516
(PB80-810419; NTIS/PS-79/0514; NTIS/PS-78/0516) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Laser beam damage to laser materials such as optical glass, glass fibers, alkali metal halides, metals, mirrors, optical coatings, dielectrics, semiconductors, and matrix materials is studied. The majority of these citations concern infrared laser damage to infrared optical materials. This updated bibliography contains 217 abstracts, 10 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-29703* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR SLICING SILICON WAFERS Patent
Earl R. Collins, inventor (to NASA) (JPL) Issued 4 Mar. 1980 6 p Filed 16 Oct. 1978 Supersedes N79-10245 (17 - 01, p 0033) Sponsored by NASA
(NASA-Case-NPO-14406-1; US-Patent-4,191,159; US-Patent-Appl-SN-951828; US-Patent-Class-125-21; US-Patent-Class-83-820) Avail: US Patent and Trademark Office CSCL 13I

An improved system is described which has at least one endless band saw blade that is characterized by a continuously regenerated cutting edge and is unidirectionally driven along a pair of courses extended in mutual parallelism through a cutting station located near the midportion of the courses. The blade is supported at the cutting station by pairs of guides continuously rotated through less than 360 deg of angular displacement during each cutting operation in order to continuously regenerate the blade supporting surfaces of the guide. Blade wobble is thus substantially eliminated.
Official Gazette of the U.S. Patent and Trademark Office

N80-29704*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR SEQUENTIALLY TRANSPORTING CONTAINERS Patent Application
Jerry L. Hudgins, inventor (to NASA) Filed 11 Jul. 1980 20 p
(NASA-Case-MFS-23846; US-Patent-Appl-SN-168944) Avail: NTIS HC A02/MF A01 CSCL 13I

An apparatus for transferring and manipulating a plurality of containers in a sequence is disclosed including a mechanical manipulator arm having a gripping device which automatically picks up a container at a fixed pickup position and transfers it to a processing station. At a processing station, the container is loaded with silicon wafers and thereafter returned to the pickup and return station. A plurality of the containers may be processed in sequence from the fixed pickup position by providing a movable carriage upon which container pedestal platforms are supported, at least one of which is an elevator platform. Sensing switches may be provided for sensing movements of the arm, carriage, and elevator platform whereby the entire apparatus may be controlled automatically avoiding the need to handle the wafers manually to reduce the possibility of contamination. NASA

N80-29705*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD FOR MILLING AND DRILLING GLASS Patent Application
Stephen H. Rice, inventor (to NASA) Filed 30 Jun. 1980 13 p
(NASA-Case-GSC-12636-1; US-Patent-Appl-SN-173520) Avail: NTIS HC A02/MF A01 CSCL 13H

A process is disclosed for machining glass in which a rotating carbide working surface is placed under minimum pressure against an area of glass to be worked. Concurrently, the region between the working surface and the area of glass is wetted with a lubricant consisting essentially of a petroleum carrier, a complex mixture of esters, and a complex mixture of naturally occurring aromatic oils. NASA

N80-29706*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROTORDYNAMIC INSTABILITY PROBLEMS IN HIGH-PERFORMANCE TURBOMACHINERY
1980 463 p refs Conf. held at College Station, 12-14 May 1980; sponsored by Texas A and M Univ., Louisville Univ., and AROD
(NASA-CP-2133; E-413) Avail: NTIS HC A20/MF A01 CSCL 13I

Diagnostic and remedial methods concerning rotordynamic instability problems in high performance turbomachinery are discussed. Instabilities due to seal forces and work-fluid forces are identified along with those induced by rotor bearing systems. Several methods of rotordynamic control are described including active feedback methods, the use of elastometric elements, and the use of hydrodynamic journal bearings and supports. For individual titles, see N80-29707 through N80-29733.

N80-29707*# Phillips Petroleum Co. Europe-Africa, London (England).
FIELD EXPERIENCES WITH ROTORDYNAMIC INSTABILITY IN HIGH-PERFORMANCE TURBOMACHINERY
H. E. Doyle *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 3-13 (For

primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Two field situations illustrate the consequences of rotordynamic instability in centrifugal compressors. One involves the reinjection of produced gas into a North Sea oil formation for the temporary extraction of crude. The other describes on-shore compressors used to deliver natural gas from off-shore wells. The problems which developed and the remedies attempted in each case are discussed. Instability problems resulted in lost production, extended construction periods and costs, and heavy maintenance expenditures. The need for effective methods to properly identify the problem in the field and in the compressor design stage is emphasized. M.G.

N80-29708*# Southwest Research Inst., San Antonio, Tex.
FIELD VERIFICATION OF LATERAL-TORSIONAL COUPLING EFFECTS ON ROTOR INSTABILITIES IN CENTRIFUGAL COMPRESSORS
J. C. Wachel and F. R. Szenasi *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 15-34 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Lateral and torsional vibration data obtained on a centrifugal compressor train which had shaft instabilities and gear failures is examined. The field data verifies that the stability of centrifugal compressors can be adversely affected by coincidence of torsional natural frequencies with lateral instability frequencies. The data also indicates that excitation energy from gear boxes can reduce stability margins if energy is transmitted either laterally or torsionally to the compressors. The lateral and torsional coupling mechanisms of shaft systems is discussed. The coupling mechanisms in a large industrial compressor train are documented and the potential effect on rotor stability is demonstrated. Guidelines are set forth to eliminate these potential problems by minimizing the interaction of torsional and lateral responses and their effect on rotor stability. M.G.

N80-29709*# Mechanical Technology, Inc., Latham, N. Y.
PRACTICAL EXPERIENCE WITH UNSTABLE COMPRESSORS
Stojan B. Malanoski *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 35-43 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01

Using analytical mathematical modeling techniques for the system components, an attempt is made to gauge the destabilizing effects in a number of compressor designs. In particular the overhung (or cantilevered) compressor designs and the straddle-mounted (or simply supported) compressor designs are examined. Recommendations are made, based on experiences with stable and unstable compressors, which can be used as guides in future designs. High and low pressure compressors which operate well above their fundamental rotor-bearing lateral natural frequencies can suffer from destructive subsynchronous vibration. Usually the elements in the system design which contribute to this vibration, other than the shafting and the bearings, are the seals (both gas labyrinth and oil breakdown bushings) and the aerodynamic components. M.G.

N80-29710*# Ingersoll-Rand Co., Easton, Pa.
ANALYSIS AND IDENTIFICATION OF SUBSYNCHRONOUS VIBRATION FOR A HIGH PRESSURE PARALLEL FLOW CENTRIFUGAL COMPRESSOR
R. G. Kirk, J. C. Nicholas, G. H. Donald, and R. C. Murphy *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 45-63 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The summary of a complete analytical design evaluation of an existing parallel flow compressor is presented and a field vibration problem that manifested itself as a subsynchronous vibration that tracked at approximately 2/3 of compressor speed is reviewed. The comparison of predicted and observed peak response speeds, frequency spectrum content, and the performance of the bearing-seal systems are presented as the events of the field problem are reviewed. Conclusions and recommendations are made as to the degree of accuracy of the analytical techniques used to evaluate the compressor design. M.G.

N80-29711*# Allis-Chalmers Mfg. Co., Milwaukee, Wis.
SUBSYNCHRONOUS INSTABILITY OF A GEARED CENTRIFUGAL COMPRESSOR OF OVERHUNG DESIGN
J. H. Hudson and L. J. Wittman *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 67-83 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The original design analysis and shop test data are presented for a three stage (postar) air compressor with impellers mounted on the extensions of a twin pinion gear, and driven by an 8000 hp synchronous motor. Also included are field test data, subsequent rotor dynamics analysis, modifications, and final rotor behavior. A subsynchronous instability existed on a geared, overhung rotor. State-of-the-art rotor dynamics analysis techniques provided a reasonable analytical model of the rotor. A bearing modification arrived at analytically eliminated the instability.M.G.

N80-29712*# Bently Nevada Corp., Minden.
THE PARAMETERS AND MEASUREMENTS OF THE DESTABILIZING ACTIONS OF ROTATING MACHINES, AND THE ASSUMPTIONS OF THE 1950'S
Donald E. Bently *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 95-106 (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The measurability of destabilizing actions is demonstrated for a rotor built to produce a forward circular, self excited malfunction (gas whip). It is argued that the continued use of past modeling techniques is unfortunate in that it has led to the use of inappropriate words to express what is happening and a lack of full understanding of the category of forward circular whip instability mechanisms. M.G.

N80-29713*# Kobe Steel Ltd. (Japan).
ASYNCHRONOUS VIBRATION PROBLEM OF CENTRIFUGAL COMPRESSOR
Takashi Fujikawa, Naotsugi Ishiguro, and Mitsuhiko Ito *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 109-118 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

An unstable asynchronous vibration problem in a high pressure centrifugal compressor and the remedial actions against it are described. Asynchronous vibration of the compressor took place when the discharge pressure (Pd) was increased, after the rotor was already at full sppeed. The typical spectral data of the shaft vibration indicate that as the pressure Pd increases, pre-unstable vibration appears and becomes larger, and large unstable asynchronous vibration occurs suddenly (Pd = 5.49MPa). A computer program was used which calculated the logarithmic decrement and the damped natural frequency of the rotor bearing systems. The analysis of the log-decrement is concluded to be effective in preventing unstable vibration in both the design stage and remedial actions. M.G.

N80-29714*# Louisville Univ., Ky. Mechanical Engineering Dept.
TESTING OF TURBULENT SEALS FOR ROTODYNAMIC COEFFICIENTS
Dara W. Childs, John B. Dressman, and S. Bart Childs *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 121-138 refs Prepared in cooperation with Texas A and M Univ., College Station (For primary document see N80-29706 20-37)
(Grant NsG-3200)
Avail: NTIS HC A20/MF A01 CSCL 13I

A test program developed for dynamic testing of straight and convergent-tapered seals, with the capability of separately determining both direct and cross-coupled stiffness, damping, and added mass coefficients is described. The test apparatus causes the seal journal to execute small-eccentricity centered circular orbits within its bearings. Dynamic measurements are made and recorded of the seal-displacement-vector components, and of the pressure field. The pressure field is integrated to

yield seal reaction force components. The displacement and force vector components are analyzed via a generalized Newton-Raphson procedure to yield the desired seal dynamic coefficients. Representative test data are provided and discussed. M.G.

N80-29715*# Kobe Univ. (Japan). Engineering Dept.
EVALUATION OF INSTABILITY FORCES OF LABYRINTH SEALS IN TURBINES OR COMPRESSORS
Tkuakuzo Iwatsubo *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 139-167 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The effects of a force induced by the labyrinth seal on the stability of rotor systems and the factors of the seal which affect the stability are investigated. In the analysis, it is assumed that the fluid in the seal is steady and that the rotor is set vertically in order to avoid the effects of gravity force. The force induced by the seal is expressed in terms proportional to the velocity and displacement of the rotor and is deduced to that expression for the oil film force in journal bearings. That force is taken into account in the equations of motion; then the stability of the system is discussed by energy concept. The force induced by the labyrinth seal always makes the rotor system unstable, and the tendency is marked when seal leakages are small. The resonance point of the rotor system is also affected by the labyrinth seal (the resonance point of the rotor system is removed by the seal leakages). The force induced by the labyrinth seal was measured by using a water-tunnel experimental system which was designed to measure the labyrinth seal force by using the similarity between gas and liquid flow theory. M.G.

N80-29716*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DAMPING IN RING SEALS FOR COMPRESSIBLE FLUIDS
David P. Fleming *In its* Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 169-188 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

An analysis is presented to calculate damping in ring seals for a compressible fluid. Results show that damping in tapered ring seals (optimized for stiffness) is less than that in straight bore ring seals for the same minimum clearance. Damping in ring seals can promote fractional frequency whirl and can, thus, be detrimental. Thus, tapered seals can benefit rotor and seal stability by having lower damping as well as higher stiffness. Use of incompressible results leads to large errors. Author

N80-29717*# Stuttgart Univ. (West Germany). Institut fuer Thermische Stroemungsmaschinen.
FLOW INDUCED SPRING COEFFICIENTS OF LABYRINTH SEALS FOR APPLICATION IN ROTOR DYNAMICS
H. Benckert and J. Wachter *In* NASA. Lewis Res. Center Rotodyn. Instability Probl. in High-Performance Turbomachinery 1980 p 189-212 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Flow induced aerodynamic spring coefficients of labyrinth seals are discussed and the restoring force in the deflection plane of the rotor and the lateral force acting perpendicularly to it are also considered. The effects of operational conditions on the spring characteristics of these components are examined, such as differential pressure, speed, inlet flow conditions, and the geometry of the labyrinth seals. Estimation formulas for the lateral forces due to shaft rotation and inlet swirl, which are developed through experiments, are presented. The utilization of the investigations is explained and results of stability calculations, especially for high pressure centrifugal compressors, are added. Suggestions are made concerning the avoidance of exciting forces in labyrinths. M.G.

N80-29718*# Hitachi Ltd., Tsuchiura (Japan). Mechanical Engineering Research Lab.
HYDRAULIC FORCES CAUSED BY ANNULAR PRESSURE SEALS IN CENTRIFUGAL PUMPS
T. Iino and H. Kaneko *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 213-225 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The hydraulic forces caused by annular pressure seals were investigated. The measured inlet and exit loss coefficients of the flow through the seals were much smaller than the conventional values. The results indicate that the damping coefficient and the inertia coefficient of the fluid film in the seal are not affected much by the rotational speed or the eccentricity of the rotor, though the stiffness coefficient seemed to be influenced by the eccentricity. R.C.T.

N80-29719*# California Inst. of Tech., Pasadena.
A TEST PROGRAM TO MEASURE FLUID MECHANICAL WHIRL-EXCITATION FORCES IN CENTRIFUGAL PUMPS
C. E. Brennen, A. J. Acosta, and T. K. Caughey *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 229-247 refs (For primary document see N80-29706 20-37)
(Contract NAS8-33108)
Avail: NTIS HC A20/MF A01 CSCL 13I

The details of a test program for the measurement of the unsteady forces on centrifugal impellers are discussed. Various hydrodynamic flows are identified as possible contributors to these destabilizing forces. R.C.T.

N80-29720*# Technical Univ. of Denmark, Copenhagen.
EFFECT OF FLUID FORCES ON ROTOR STABILITY OF CENTRIFUGAL COMPRESSORS AND PUMPS
Jorgen Colding-Jorgensen *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 249-265 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A simple two dimensional model for calculating the rotordynamic effects of the impeller force in centrifugal compressors and pumps is presented. It is based on potential flow theory with singularities. Equivalent stiffness and damping coefficients are calculated for a machine with a vaneless volute formed as a logarithmic spiral. It is shown that for certain operating conditions, the impeller force has a destablizing effect on the rotor. R.C.T.

N80-29721*# Cornell Univ., Ithaca, N. Y.
NON-SYNCHRONOUS WHIRLING DUE TO FLUID-DYNAMIC FORCES IN AXIAL TURBO-MACHINERY ROTORS
Shan Fu Shen and Vinod G. Mengle *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 267-284 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The role of fluid forces acting on the blades of an axial turborotor with regards to whirling was analyzed. The dynamic equations were formulated for the coning mode of an overhung rotor. The exciting forces due to the motion were defined through a set of rotor stability derivatives, and analytical expressions of the aerodynamic contributions were found for the case of small mean stream deflection, high solidity and equivalent flat plate cascade. For a typical case, only backward whirl was indicated when the phase shifting of the rotor wake effect was ignored. A parametric study of the dynamic stability boundary reveals that a reduction in blade stagger angle, mass flow rate, fluid density and an increase in stiffness and external damping are all inducive for improved stability. R.C.T.

N80-29722*# Turbo Research, Inc., Lionville, Pa.
VIBRATION EXCITING MECHANISMS INDUCED BY FLOW IN TURBOMACHINE STAGES
William E. Thompson *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 285-302 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The quasisteady computer analysis of the perturbated centrifugal impeller passage flow was reviewed. A total of 115 stage calculations were used to define the fluid damping coefficient, delta sub fluid. Results indicate that the average total damping coefficient per stage needed for stability is delta sub total > 1.85. R.C.T.

N80-29723*# Technische Universitaet, Munich (West Germany). Institut fuer Thermische Kraftanlagen.

SELF-EXCITED ROTOR WHIRL DUE TO TIP-SEAL LEAKAGE FORCES

B. Lee and H.-J. Thomas *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 303-316 refs (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

The limitations in the performance of turbomachines which arise as a result of selfexcited vibration were investigated. Bearing forces, elastic hysteresis, and forces from fluid flow through clearances were considered as possible origins. A theoretical evaluation was made to determine the dependence of the forces form the leakage losses and from rotating flow in radial gaps. R.C.T.

N80-29724*# Tokyo Univ. (Japan).

FLUID FORCES ON ROTATING CENTRIFUGAL IMPELLER WITH WHIRLING MOTION

Hidenobu Shoji and Hideo Ohashi *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 317-328 refs Sponsored in part by the Japanese Ministry of Education and by Hitachi Ltd. (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

Fluid forces on a centrifugal impeller, whose rotating axis whirls with a constant speed, were calculated by using unsteady potential theory. Calculations were performed for various values of whirl speed, number of impeller blades and angle of blades. Specific examples as well as significant results are given. R.C.T.

N80-29725*# Heriott-Watt Univ., Edinburgh (Scotland). Mechanical Engineering Dept.

LIMIT CYCLES OF A FLEXIBLE SHAFT WITH HYDRODYNAMIC JOURNAL BEARINGS IN UNSTABLE REGIMES

R. David Brown and Henry F. Black *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 331-343 refs (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

A symmetric 3 mass rotor supported on hydrodynamic bearings is described. An approximate method of representing finite bearings is used to calculate bearing forces. As the method sums forces from a number of independent circular lobes lemon 3 and 4 lobe bearings are taken into account. The calculations are based on an axial groove bearing. Linear analysis precedes nonlinear simulation of some unstable conditions. The demonstration of small limit cycles suggests that necessarily flexible rotors e.g., helicopter tail rotors, may be practical without either tilt pad bearings or external dampers. R.C.T.

N80-29726*# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.

ON THE ROLE OF OIL-FILM BEARINGS IN PROMOTING SHAFT INSTABILITY: SOME EXPERIMENTAL OBSERVATIONS

R. Holmes *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 345-357 refs (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

The occurrence of oil whirl instability in rigid and flexible rotor systems was investigated. The effect of various bearing parameters on the oil whirl frequency and amplitude of rigid and flexible shafts supported on fluid film bearings was also studied. R.C.T.

N80-29727*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

EXPERIMENTAL RESULTS CONCERNING CENTRIFUGAL IMPELLER EXCITATIONS

J. M. Vance and F. J. Landadio *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 361-367 refs (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

The effect of working fluid on the dynamics of an impeller with radial vanes was investigated. The impeller was supported vertically from a very flexible quill shaft in order to produce a low critical speed, and to allow the fluid dynamic effects on the impeller to predominate. The shaft was supported from ball bearings, so that there was no possibility of oil whip from fluid film bearings as a destabilizing influence. The impeller was run both in the atmosphere, and submerged in working fluids contained in a cylindrical housing, open at the top. Variable speed was obtained with a dc gearmotor drive unit. The speed was measured with a proximity probe pulse tachometer and electronic digital counter. R.C.T.

N80-29728*# Massachusetts Inst. of Tech., Cambridge.

PHYSICAL EXPLANATIONS OF THE DESTABILIZING EFFECT OF DAMPING IN ROTATING PARTS

Stephen H. Crandall *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 369-382 refs (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

The destabilizing effect of rotating damping was investigated. When the rotation was faster than the whirl, rotating damping drags the orbiting particle forward. When stationary damping was also present, the stability borderline was readily determined by balancing the backward and forward drags. A key notion was that a forward whirl at rate omega a sub n with respect to stationary axes appears to be a backward whirl at rate Omega - omega sub n with respect to a system rotating supercritically at rate Omega. The growth rate of unstable whirls (or the decay rate of stable whirls was readily estimated by a simple energy balance. R.C.T.

N80-29729*# Politechnika Lodzka (Poland).

PARAMETRIC INSTABILITIES OF ROTOR-SUPPORT SYSTEMS WITH APPLICATION TO INDUSTRIAL VENTILATORS

Zdzislaw Parszewski, Tanusz Krodkiemski, and Krzysztof Marynowski *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 383-400 refs (For primary document see N80-29706 20-37)

Avail: NTIS HC A20/MF A01 CSCL 13I

Rotor support systems interaction with parametric excitation is considered for both unequal principal shaft stiffness (generators) and offset disc rotors (ventilators). Instability regions and types of instability are computed in the first case, and parametric resonances in the second case. Computed and experimental results are compared for laboratory machine models. A field case study of parametric vibrations in industrial ventilators is reported. Computed parametric resonances are confirmed in field measurements, and some industrial failures are explained. Also the dynamic influence and gyroscopic effect of supporting structures are shown and computed. R.C.T.

N80-29730*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.

INSTABILITY THRESHOLDS FOR FLEXIBLE ROTORS IN HYDRODYNAMIC BEARINGS

Paul E. Allaire and Ronald D. Flack *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 403-427 refs (For primary document see N80-29706 20-37)

(Grant NsG-3177; Contract DE-AC01-79ET-13151; Grant RC-A-77-6C)

Avail: NTIS HC A20/MF A01 CSCL 13I

Two types of fixed pad hydrodynamic bearings (multilobe and pressure dam) were considered. Optimum and nonoptimum geometric configurations were tested. The optimum geometric configurations were determined by using a theoretical analysis and then the bearings were constructed for a flexible rotor test rig. It was found that optimizing bearings using this technique produces a 100% or greater increase in rotor stability. It is shown that this increase in rotor stability is carried out in the absence of certain types of instability mechanisms such as aerodynamic crosscoupling. However, the increase in rotor stability should greatly improve rotating machinery performance in the presence of such forces as well. R.C.T.

N80-29731*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.

STABILIZATION OF AERODYNAMICALLY EXCITED TURBOMACHINERY WITH HYDRODYNAMIC JOURNAL

BEARINGS AND SUPPORTS

Lloyd E. Barrett and Edgar J. Gunter *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 429-452 refs (For primary document see N80-29706 20-37)
(Grant NsG-3105; Contracts DAAG29-77-C-0009; EF-76-S-01-2479)
Avail: NTIS HC A20/MF A01 CSCL 13I

A method of analyzing the first mode stability and unbalance response of multimass flexible rotors is presented whereby the multimass system is modeled as an equivalent single mass modal model including the effects of rotor flexibility, general linearized hydrodynamic journal bearings, squeeze film bearing supports and rotor aerodynamic cross coupling. Expressions for optimum bearing and support damping are presented for both stability and unbalance response. The method is intended to be used as a preliminary design tool to quickly ascertain the effects of bearing and support changes on rotor-bearing system performance. R.C.T.

N80-29732*# Mechanical Technology, Inc., Latham, N. Y.
USE OF ELASTOMERIC ELEMENTS IN CONTROL OF ROTOR INSTABILITY
Anthony J. Smalley *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 453-465 refs (For primary document see N80-29706 20-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The dynamic characteristics of elastomeric supports are discussed. Stiffness and damping characteristics for elastomers of various geometries including O-rings, buttons loaded in compression, and rectangular elements loaded in shear are presented. The effects of frequency, temperature, and amplitude are illustrated, as well as the effects of material and geometry. Empirical design methods are illustrated, and several examples are presented where elastomers have successfully controlled both synchronous and nonsynchronous vibrations. R.C.T.

N80-29733*# Virginia Univ., Charlottesville.
FEASIBILITY OF ACTIVE FEEDBACK CONTROL OF ROTORDYNAMIC INSTABILITY
James W. Moore, David W. Lewis, and John Heinzman *In* NASA. Lewis Res. Center Rotordyn. Instability Probl. in High-Performance Turbomachinery 1980 p 467-476 (For primary document see N80-29706 20-37)
(Contract DE-AC01-79ET-13151)
Avail: NTIS HC A20/MF A01 CSCL 13I

Some of the considerations involved in the use of feedback control as a means of eliminating or alleviating rotordynamic instability are discussed. A simple model of a mass on a flexible shaft is used to illustrate the application of feedback control concepts. R.C.T.

N80-29734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION OF OPTIMIZED-DESIGN TAPERED-ROLLER BEARINGS TO 2.4 MILLION DN
Richard J. Parker and Stanley I. Pinel Aug. 1980 18 p refs Sponsored in part by Industrial Tectonics, Inc., Compton, Calif.
(NASA-TP-1714; E-270) Avail: NTIS HC A02/MF A01 CSCL 13I

The performance of 120.65 mm (4.75 in.) bore high speed design, tapered roller bearings was investigated at shaft speeds to 20,000 rpm (2.4 million DN) under combined thrust and radial load. The test bearing design was computer optimized for high speed operation. Temperature distribution bearing heat generation were determined as a function of shaft speed, radial and thrust loads, lubricant flow rates, and lubricant inlet temperature. The high speed design, tapered roller bearing operated successfully at shaft speeds up to 20,000 rpm under heavy thrust and radial loads. Bearing temperatures and heat generation with the high speed design bearing were significantly less than those of a modified standard bearing tested previously. Cup cooling was effective in decreasing the high cup temperatures to levels equal to the cone temperature. Author

N80-29735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILM THICKNESS FOR DIFFERENT REGIMES OF FLUID-FILM LUBRICATION
Bernard J. Hamrock 1980 14 p refs Presented at lecture series at Lulea, Sweden, 24 Jul. - 16 Aug. 1980
(NASA-TM-81550; E-508) Avail: NTIS HC A02/MF A01 CSCL 11H

Film thickness equations are provided for four fluid-film lubrication regimes found in elliptical contacts. These regimes are isoviscous-rigid; viscous-rigid; elastohydrodynamic lubrication of low-elastic-modulus materials (soft EHL), or isoviscous-elastic; and elasthydrodynamic lubrication of high-elastic-modulus materials (hard EHL), or viscous-elastic. The influence or lack of influence of elastic and viscous effects is the factor that distinguishes these regimes. The results are presented as a map of the lubrication regimes, with film thickness contours on a log-log grid of the viscosity and elasticity for three values of the ellipticity parameter. E.D.K.

N80-29736# Mechanical Technology, Inc., Latham, N. Y.
THE DEVELOPMENT OF AN AUTOMATED ROLLER INSPECTION SYSTEM USING NONCONTACTING SENSORS Final Report, Nov. 1977 - Feb. 1979
Martin W. Eusepi Wright-Patterson AFB, Ohio AFAL Nov. 1979 189 p refs
(Contract F33615-77-C-3142)
(AD-A085740; MTI-79TR60; AFAL-TR-79-2076) Avail: NTIS HC A09/MF A01 CSCL 13/9

An automated computer oriented inspection for measuring the dimensional characteristics of high DN bearing rollers has been designed. The system is based on the use of non contacting miniature capacitance probes having a sensitivity of 1000 volts/in. and a line scan camera employing photo diodes combined with an enlarging lens system to provide a 40 x 10 to the -6 in./count sensitivity. The automated inspection system design is based on the results of a laboratory investigation of gaging techniques and the performance evaluation of non automated breadboard versions of the system. GRA

N80-29737# GARD, Inc., Niles, Ill.
ACOUSTIC EMISSION WELD MONITOR SYSTEM: DATA ACQUISITION AND INVESTIGATION Final Report, Oct. 1978 - Sep. 1979
R. A. Groenwald, T. A. Mathieson, and C. T. Kedzior (Army Tank-Automotive Research and Development Command, Warren, Mich.) Oct. 1979 71 p
(Contract DAAK30-78-C-0123)
(AD-A085518; TARADCOM-TR-12468) Avail: NTIS HC A04/MF A01 CSCL 17/1

The standard weld inspection techniques of radiography and ultrasonics have intrinsic disadvantages. The new technology of acoustic emission (AE) has shown an applicability to weld inspection which could overcome such disadvantages. This program is directed at utilizing acoustic emission as a weld monitoring technique on a specific Army welding application. The reported work is phase 1 of an Army program to develop a microprocessor based Acoustic Emission Weld Monitor (AEWM) for the purpose of in-process monitoring of armor plate welding. The intended use of this AEWM is to monitor the production welding performed in the fabrication of heavy armored vehicles. The objectives of this phase are to: (a) perform laboratory MIG welding of armor plate with controlled induction of critical flaws; (b) collect acoustic emission data generated during the welding; (c) perform a data analysis to correlate the recorded AE data with flaw presence; and (d) predict the accuracy with which AE is able to detect and locate the weld flaws as well as discriminate between flaw types. GRA

N80-29738# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
A REVIEW OF ADVANCED VEHICULAR DIESEL RESEARCH AND DEVELOPMENT PROGRAMS WHICH HAVE POTENTIAL APPLICATION TO STATIONARY DIESEL POWER PLANTS Final Report, 1 Mar. - 1 Dec. 1979
Andrew W. Kaupert Wright Patterson AFB, Ohio AFWAL Mar. 1980 83 p refs
(AF Proj. 3145)
(AD-A085601; AFWAL/PO-79-036; AFWAL-TR-80-2014)
Avail: NTIS HC A05/MF A01 CSCL 10/2

This report, prepared for the Aerospace Power Division, Aero

Propulsion Laboratory, Wright-Patterson AFB, reviews, assesses, and summarizes the research and development status of advanced diesel engine/vehicular component technologies, and identifies those systems which may have application to diesel power plants utilized as stationary engine power sources. GRA

N80-29739# Cornell Univ., Ithaca, N. Y. Dept. of Structural Engineering.
NUMERICAL SOLUTIONS FOR COUPLED MAGNETOMECHANICS Interim Technical Report, 1 Feb. 1979 - 31 Jan. 1980
Kuan-Ya Yuan, Francis C. Moon, and John F. Abel 1 Feb. 1980 87 p refs
(Contract N00014-79-C-0224)
(AD-A085747; Rept-80-5) Avail: NTIS HC A05/MF A01 CSCL 20/3

This technical report describes the accomplishments of the first year of a research project directed toward developing numerical methods for the coupled analysis of forces, currents, and stresses in thin elastic structures exposed to time-dependent magnetic fields. To date research has focused on the response of flat plates to steady state harmonic and pulsed fields. A stream function for the induced eddy currents is used to reduce the three dimensional electromagnetic problem to an integro-differential equation in two dimensions. GRA

N80-29740# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TOWING RESISTANCE Final Report
25 Jun. 1980 6 p
(AD-A086144; TOP-2-2-605) Avail: NTIS HC A02/MF A01 CSCL 13/6

Describes procedures for determining vehicle power losses attributable to the suspension system and vehicle braking effect available for descending grades. Discusses vehicle preparation, instrumentation, data reduction, and data presentation. Applicable to wheeled and tracked vehicles. GRA

N80-29741# Barnes and Reinecke, Inc., Elk Grove, Ill.
STEAM ENGINE ANALYSIS Final Technical Report
William G. Allbach, Merle J. Smith, and Robert F. Wenshutonis Jun. 1979 141 p
(Contract ET-77-C-01-8917)
(FE-8917-2) Avail: NTIS HC A07/MF A01

Familiarization, cost, and thermodynamic analysis were made of a prototype Rankine cycle steam engine intended for application in an underground vehicle. The cost analysis was made, by direction, for the material and direct labor based on a single prototype steam engine extended to lots of 100 units and 500 units annually. The conclusions derived from the familiarization and the cost analysis are that the cost is higher than alternate vehicle power systems, the design and configuration is not in a state of reproductibility and maintainability, and must be reconfigured for cost reduction. The thermodynamic analysis of the effect of the steam power plant upon the mine environment indicates that the steady state temperature in the mine entry air downstream of the steam powered vehicle would increase significantly while the steam engine is operating, unless the ventilation air flowrate is increased above the minimum 9000 CFM requirement. DOE

N80-29742# California Univ., Livermore. Lawrence Livermore Lab.
WELDING STAINLESS STEELS FOR STRUCTURES OPERATING AT LIQUID HELIUM TEMPERATURE
Charles E. Witherell 18 Apr. 1980 68 p refs Presented at the 61st Ann. Meeting of the Am. Welding Soc., Los Angeles, 14 Apr. 1980
(Contract W-7405-eng-48)
(UCRL-83863; CONF-800462-1) Avail: NTIS HC A04/MF A01

A three year study was conducted to determine the feasibility of producing heavy section welds having usable levels of strength and toughness at 4.2 K for fabrication of these structures in Type 304LN plate. Seven welding processes were evaluated. Test weldments in full thickness plate were made under severe restraint to simulate that of actual structures. Type 316L filler metal was used for most welds. Welds deposited under some conditions and which solidify as primary austenite have exhibited intergranular embrittlement of 4.2 K. This is believed to be associated with grain boundary metal carbides or carbonitrides precipitated during reheating of already deposited beads by subsequent passes. Weld deposits which solidify as primary delta ferrite appear immune. Through use of fully austenitic filler metals of low nitrogen content under controlled shielded metal arc welding conditions and through use of filler metals solidifying as primary delta ferrite where only minimum residuals remain to room temperature, welds of Type 316L composition have been made with 4.2 K yield strength matching that of Type 304L plate and acceptable levels of soundness, ductility and toughness. DOE

N80-29743# California Univ., Livermore. Lawrence Livermore Lab.
HOLOGRAPHIC NONDESTRUCTIVE EVALUATION OF SPHERICAL/KEVLAR/EPOXY PRESSURE VESSELS
Donald M. Boyd and Bruce W. Maxfield 23 May 1979 16 p refs Presented at the 29th Meeting of the Mech. Failure Prevention Group, Gaithersburg, Md., 23-25 May 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84280; CONF-7905151-1) Avail: NTIS HC A02/MF A01

Three spherical kevlar/epoxy pressure vessels were evaluated using holographic interferograms provide information on the failure modes, displacement profile, and possible fiber damage. The holograms show a symmetric anisotropic displacement pattern even though the vessels failed due to a leak in the aluminum mandrels. The presence of a biconvex fringe pattern found during the testing of vessel three is believed to indicate matrix crazing. This information is useful for burst type failure analysis. Holographic interferometry was shown to supply information on the characteristics of kevlar/epoxy pressure vessels under stress. DOE

N80-29744# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
THE EFFICIENCY OF ELECTROTHERMICALLY HEATED HYDRAZINE GENERATORS [LEISTUNGSVORHERSAGE ELEKTROTHERMISCH AUFGEHEIZTER HYDRAZINTRIEBWERKE]
D. Hayn, M. Braitinger, and R. H. Schmucker (Bayern-Chemie G.m.b.H., Ottobrunn, West Germany) Aug. 1978 35 p refs In GERMAN
(TUM-RT-KB-78/5) Avail: NTIS HC A03/MF A01

Improvement of the performance of hydrazine engines by increasing the enthalpy of the decomposition products using an electrical heater was studied. The increase in efficiency is limited by the maximum temperature permitted in the combustion chamber and by the energy transformation in the expansion jet. Theoretical and experimental results are compared. Author (ESA)

N80-29745# Rocket Research Corp., Seattle, Wash.
USE OF SODIUM AZIDE IN GAS GENERANTS FOR INFLATABLE RESTRAINT SYSTEM INFLATORS Final Report
Eckart W. Schmidt and Dorothy J. Day 22 Aug. 1979 119 p refs
(PB80-170038; RRC-79-ES-105A; AOPA-1001-Rev-A) Avail: NTIS HC A06/MF A01 CSCL 13L

The chemistry and hazard aspects of sodium azide are considered with respect to its use as a constituent in gas generants for inflatable automotive occupant restraint system inflators. It is concluded that the benefit-to-risk-ratio of lives saved and injuries avoided by inflatable restraints versus accidental poisonings by gas generant chemicals is so many orders of magnitude above 1.0 that the use of toxic chemicals in inflators appears to be justified. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-29746*# Sperry Univac, St. Paul, Minn.
STUDY OF INTERMITTENT FIELD HARDWARE FAILURE DATA IN DIGITAL ELECTRONICS
Edward J. ONeill and James R. Halverson Jun. 1980 68 p refs
(Contract NAS1-15574)
(NASA-CR-159268) Avail: NTIS HC A04/MF A01 CSCL 14D

The collection and analysis of data concerning intermittent failures in digital devices was performed using data from a computer design for shipboard usage. The failure data consisted of actual field failures classified by failure mechanisms and their likelihood of having been intermittent, potentially intermittent, or hard. Each class was studies with respect to computer operation in the ranges of 0 to 2,000 hours, 0 to 5, hours, and 0 to 10,000 hours. The study was done at the computer level as well as the microcircuit level. Results indicate that as age increases, the quasi-intermittent failure rate increases and the mean time to failure descreases. E.D.K.

N80-29747# Aeronautical Research Labs., Melbourne (Australia).
ULTRASONIC CAUSTICS IN NONDESTRUCTIVE EVALUATION
P. A. Doyle Jul. 1979 22 p refs
(ARL-Mat-111; AR-001-747) Avail: NTIS HC A02/MF A01

Caustics formed in the field diffracted by defects are explored theoretically as a possible approach to the inverse scattering problem for ultrasonic nondestructive evaluation. The case of crack-like defects is considered in detail using the geometrical theory diffraction. The involute of the far field caustic reproduces the projection of the crack edge in the incident beam direction for a plane incident wavefront. This purely geometrical inversion is carried out for the astroid and its involute, the elliptical edge. For a general edge shape, the complete inversion requires one further length measurement which may be carried out in some cases by further experiments with caustics. Useful limitations on the possible shapes of caustics are explained on the basis of catastrophe theory. Calculations show that the inherent intensity level change and width over which it occurs for 0 typical ultrasonic caustic are adequate for observation. Some discussion is given of experimental requirements, as well as of caustics formed in the near field of a crack and of those formed by voids and inclusions. Caustics may prove to be a useful adjunct to ultrasonic imaging systems for the inspection of fatigue cracks. E.D.K.

N80-29748# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
DEVELOPMENT OF PROCEDURES FOR NONDESTRUCTIVE TESTING OF CONCRETE STRUCTURES. REPORT 2: FEASIBILITY OF SONIC PULSE-ECHO TECHNIQUE
A. Mitchell Alexander Apr. 1980 30 p refs
(AD-A085598; WES-MP-C-77-11-2) Avail: NTIS HC A03/MF A01 CSCL 13/13

A sonic pulse-echo system has been developed that will measure the length of long, thin concrete members such as piles and detect discontinuities within the members. A longitudinal pulse is introduced into the concrete at a surface by mechanical impact, and the echo time is measured using the time base of an oscilloscope. The velocity of the longitudinal wave is determined initially on a known length of similar concrete. In situ pile lengths up to 70 ft have been measured successfully in soil with low damping characteristics. The system successfully measured the lengths of three drilled piers and detected the location of flaws in the piers incorporated by design at the University of Texas at Austin. Measurements of thin slabs were found to be more difficult than measurements of piles. Because reflections of echoes in thin sections are of much higher frequency, elastic pulses containing higher frequencies must be introduced into the concrete. Research should continue in an effort to provide a pulse-echo system that will be capable of nondestructive evaluation of all geometries of Civil Works structures. An ultrasonic unit of low frequency and high energy level should be designed to improve resolution above that of a sonic system for thin sections. GRA

N80-29749# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
FLAW CLASSIFICATION IN WELDED PLATES WITH A MICROPROCESSOR CONTROLLED FLAW DETECTOR Annual Report
Joseph L. Rose, J. Bruce Nestleroth, and Edward G. Poplawski 22 Feb. 1980 35 p refs
(Contract N00014-77-C-0607; NR Proj. 064-583)
(AD-A085755; AR-1) Avail: NTIS HC A03/MF A01 CSCL 13/13

The purpose of this paper is to manifest that a microprocessor, when utilized in connection with an ultrasonic flaw detector, can reliably regulate an ultrasonic inspection process. By virtue of several concentrated laboratory trials and accompanying analysis with the microprocessor-flaw detector combination, it will be demonstrated that dependable, speedy, and cost effective flaw detection is within the realm of reality. Specifically, this particular study focuses on the microprocessor controlled evaluation of steel plates. While it is true that the overall procedure employed here involved itself with flaw classification in one area (welds in steel plates), it will become apparent that applications are not restricted to steel plates. Cognizant of this fact, this paper will also provide insight into other areas pertinent to the study. GRA

N80-29750# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
QUANTITATIVE NONDESTRUCTIVE EVALUATION
Dallas G. Smith and John A. Schaeffel, Jr. Oct. 1979 175 p refs
(AD-A085945; DRSMI/RL-TR-80-6) Avail: NTIS HC A08/MF A01 CSCL 11/4

This manual has been prepared primarily for the non-NDE specialist. Its aim is to increase understanding of NDE capabilities among those involved in structural design and fracture mechanics calculations, and to provide physical details pertaining to most of the important NDE techniques. Since NDE has been so actively applied in the aerospace industry most of the application examples discussed are related to aerospace structures; however the basic ideas apply to any structure containing fracture critical components. The introduction discusses the relationship of fracture mechanics and quantitative NDE. The present practice of NDE, including military specifications, airplane inspection manuals, and inspector training are discussed next. The 'big five' methods of NDE - liquid penetrant, magnetic particle, ultrasonic inspection, eddy current, and radiography - are introduced as well as certain advanced inspection methods - methods still undergoing development. The state-of-the-art, the sensitivity and reliability, of various methods along with the statistical analysis for determining flaw detection probability and confidence levels is presented. Excerpts from two actual airplane inspection manuals are included in the appendix to illustrate the degree to which instructions to inspectors are detailed and specified. GRA

N80-29751# Harry Diamond Labs., Adelphi, Md.
LASER SYSTEM FOR THE DETECTION OF FLAWS IN SOLIDS
Ronald J. Wellman May 1980 35 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A086124; HDL-TR-1902) Avail: NTIS HC A03/MF A01 CSCL 14/2

An investigation of a laser flaw detection system has been conducted. The technique replaces the piezoelectric transducers used in conventional flaw detection systems with an optical system incorporating a pair of lasers. One laser generates a high-power pulse that strikes the test sample and generates a short-pulse acoustic wave in the sample. The second laser is used in an interferometer that monitors the surface motion. The advantages of this system over conventional techniques are its speed and flexibility. Since the system is remote, i.e., no physical contact is necessary, the sample could be optically scanned very rapidly. Also, there is no limitation on the size or shape of the test object as there might be with conventional methods. GRA

N80-29752# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980
Guy E. Habercom, Jr. May 1980 146 p Supersedes NTIS/PS-79/0520; NTIS/PS-78/0359
(PB80-810559; NTIS/PS-79/0520; NTIS/PS-78/0359) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Fundamental principles of nondestructive testing and inspection by use of infrared devices are investigated in these reports gathered from a worldwide literature survey. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications research. This updated bibliography contains 138 abstracts, 28 of which are new entries to the previous edition. GRA

N80-29753# National Technical Information Service, Springfield, Va.
INFRARED TECHNIQUES FOR NONDESTRUCTIVE TESTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Guy E. Habercom, Jr. May 1980 125 p Supersedes NTIS/PS-79/0519; NTIS/PS-78/0358
(PB80-810542; NTIS/PS-79/0519; NTIS/PS-78/0358) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Fundamental principles of nondestructive testing and inspection, by using of infrared devices, are investigated in these research reports. Tire flaws, electronic circuit defects, and flaws in bonded surfaces are among the applications researched This updated bibliography contains 117 abstracts, 7 of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-29754 Connecticut Univ., Storrs.
DETERMINATION OF DYNAMIC STRUCTURAL STRESSES FROM EXPERIMENTAL AND MODAL ANALYSES Ph.D. Thesis
Michael Anthony Tucchio 1980 107 p
Avail: Univ. Microfilms Order No. 8017060

A methodology to determine the dynamic stresses in a structure from a few measured accelerations is presented. It is shown that while the technique is theoretically correct, it is subject to limitations due to inaccuracies in current accelerometer technology. The theory of the method is developed and checked both analytically and experimentally. A closed form solution for a simply supported beam with suddenly applied end moment and a finite element solution for a single bay frame with suddenly applied concentrated load are used to provide the analytical support. Base excitation for a cantilever beam and a multibay frame are used in the experimental verification. Dissert. Abstr.

N80-29755 Drexel Univ., Philadelphia, Pa.
TWO-DIMENSIONAL CALCULATION OF EXPLOSIVE-METAL INFORMATION PROBLEMS Ph.D. Thesis
Sheng Chih Hung 1980 121 p
Avail: Univ. Microfilms Order No. 8017858

A computer code for solving two dimensional explosive metal interaction problems is developed. Details of the theory, the finite difference formulation, the numerical solution technique, and a sample problem are presented. The metal is represented by a thin shell, capable of developing both membrane forces and bending moments. In a sample problem of an axisymmetric liner accelerated by an explosive charge, the output data of this program compares well to the two dimensional computer code EPIC. The EPIC computer code typically requires 10 times more computational time to simulate the same problem than this computer code. It is concluded that this computer code reduces the cost of calculations significantly and it is suitable for preliminary design studies of metal explosive interaction problems. Dissert. Abstr.

N80-29756 Illinois Univ., Urbana-Champaign.
VARIATIONAL PRINCIPLES IN FINITE ELASTICITY WITH APPLICATIONS Ph.D. Thesis
Sang Jin Lee 1980 70 p
Avail: Univ. Microfilms Order No. 8017970

A variational principle of the complementary energy type is derived. Trial functions for the actual deformation gradient are used in the formulation of the principle. Corresponding principles for elastic bodies subject to kinematical constraints such as incompressibility are formulated. The same approach can be used to obtain variational principles for infinitesimal deformations superposed on a known finite elastic deformation of an elastic body. For some deformations, the principle becomes an extremum principle and it can be used in conjunction with the principle of minimum potential energy. The principles are applied to the problem of the all around finite extension of a plane sheet with a circular hole and accurate estimates for the stress resultant at the outer edge for various extensions are obtained. The finite extension and torsion of an elastic cylinder is treated and bounds on the strain energy per unit length are obtained for elliptical cylinders of neo-Hookean material with axes in the ratios of 2:1 and 4:1. The bounds lead to reliable estimates for the twisting moment and the axial force. Dissert. Abstr.

N80-29757 Alfred Univ., N.Y.
THE EFFECT OF ELECTRIC FIELDS ON CRACK PROPAGATION IN GLASS Ph.D. Thesis
Mark George Schwabel 1978 70 p
Avail: Univ. Microfilms Order No. 8017488

Electric fields were applied to soda-lime glass specimens in which cracks were propagated by a fixed end, constant displacement straining device. At 23 C and 50 C in a dried air environment, the position and shape of the crack tip were monitored optically. Alternating and direct current fields of 1000 and 10,000 volts/cm were applied through aluminum electrodes which were plated on the specimen surfaces. The electrode geometries were arranged to provide electric fields which were parallel and perpendicular to the fracture generated surface. Information relevant to glass slow crack growth theories was provided. Healing of glass fracture surfaces formed by slow crack growth is inconsistent with the widely accepted Charles-Hilling theory of stress corrosion to explain environmentally assisted slow crack growth in glass. A more general theory of environment assisted slow crack growth by surface energy reduction is shown to be sufficient to explain observed slow crack growth behavior. Dissert. Abstr.

N80-29758 Engineering Sciences Data Unit, London (England).
FATIGUE STRENGTH OF STEEL CONED DISC SPRINGS
1980 16 p
(ESDU-80004; ISBN-0-85679-282-9; ISSN-0141-4089) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

Basic fatigue data are presented on which to assess the endurance of steel coned disc springs, and, to estimate the location of failure within a stack and the point on each spring at which a fatigue crack is likely to initiate. The results of the research may be applied to springs for valves, forging dies, machine tools, pneumatic equipment, and testing apparatus. The research is limited to a series combination of identical steel coned disc springs in a wide range of geometries with cone angles of less than 15 degrees, ratio of external to internal diameter less than 5, and in which no spring is deflected through the flat position. ESDU (GRA)

N80-29759 Catholic Univ. of America, Washington, D. C.
MODE CONVERSION AND RESONANCE SCATTERING OF ELASTIC WAVES FROM A CYLINDRICAL, FLUID-FILLED CAVITY Ph.D. Thesis
Sheldon Gerald Solomon 1980 97 p
Avail: Univ. Microfilms Order No. 8018456

Mode conversion and scattering of compressional and shear waves from cylindrical cavities were studied by performing partial wave expansions of the incident and scattered fields. A mathematical analysis, supported by extensive numerical

calculations, shows that each partial wave spectrum consists of a smooth background identical to that of an empty cavity and a series of resonance terms associated with the eigenvibrations of the cavity's fluid interior. Resonance scattering of elastic waves is shown to occur when circumferential waves are excited in the fluid interior of the cavity. The resonances which appear in successive normal modes of vibration of the cavity are related through a common feature of the scattering amplitude known in modern physics as a Regge pole. The scattering matrix for the cavity is defined and its unitary and symmetry properties are discussed. Argand diagrams of the trajectories of the S matrix elements in the complex plane are shown to have certain easily recognized features which are associated with the cavity resonances. Dissert. Abstr.

N80-29760 Connecticut Univ., Storrs.
A NUMERICAL MODEL FOR THREE DIMENSIONAL THERMAL STRESS ANALYSIS INCLUDING PHASE CHANGE CAPABILITY BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Calvin Kin-Fun Lai 1979 342 p
Avail: Univ. Microfilms Order No. 8017024

A general numerical model for doing three dimensional thermal stress analysis with the added capability of solving phase change problems has been developed. The model uses the finite element formulation in both the thermal and stress analysis. The analyses can be uncoupled to solve either the heat transfer problem or the stress problem independently. By direct application of the equations of elasticity and the variational principle to an assumed displacement function, a constant strain finite element is developed. In transient thermal analysis, the finite element formulation is developed by the variational method. Included in both the thermal and stress analyses are terms to accommodate nonlinear material behavior, initial states of stress and strain, and moving boundary conditions. Applying the moving heat flux boundary condition to simualte the welding arc, the model has been used to predict the transient thermal mechanical response of a welding process. The result is presented. Dissert. Abstr.

N80-29761 California Univ., Davis.
INVESTIGATION OF FUNDAMENTAL ASPECTS OF SUPERPLASTICITY Ph.D. Thesis
Adi Arieli 1979 231 p
Avail: Univ. Microfilms Order No. 8016734

A three dimensional deformation mechanism map is developed and introduced. Additional possible applications of this deformation mechanism map, such as evaluation and prediction of the creep life, are discussed. A model for the rate controlling mechanism in superplasticity is also presented. The proposed model is shown to be consistent with the microstructural and mechanical observations of superplasticity and is capable of predicting all of the microstructural, topographical and phenomenological characteristics of the superplastic flow. It is shown that many contradictory results reported in the literature of superplasticity can be reconciliated and/or explained by the proposed model. Dissert. Abstr.

N80-29762*# Massachusetts Inst. of Tech., Cambridge.
FINITE-STRAIN LARGE-DEFLECTION ELASTIC-VISCOPLASTIC FINITE-ELEMENT TRANSIENT RESPONSE ANALYSIS OF STRUCTURES
Jose J. A. Rodal and Emmett A. Witmer Jul. 1979 567 p refs
(Grant NGR-22-009-339)
(NASA-CR-159874; ASRL-TR-154-15) Avail: NTIS HC A24/MF A01 CSCL 20K

A method of analysis for thin structures that incorporates finite strain, elastic-plastic, strain hardening, time dependent material behavior implemented with respect to a fixed configuration and is consistently valid for finite strains and finite rotations is developed. The theory is formulated systematically in a body fixed system of convected coordinates with materially embedded vectors that deform in common with continuum. Tensors are considered as linear vector functions and use is made of the dyadic representation. The kinematics of a deformable continuum is treated in detail, carefully defining precisely all quantities necessary for the analysis. The finite strain theory developed gives much better predictions and agreement with experiment than does the traditional small strain theory, and at practically no additional cost. This represents a very significant advance in the capability for the reliable prediction of nonlinear transient structural responses, including the reliable prediction of strains large enough to produce ductile metal rupture. E.D.K.

N80-29763*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NOTCH SENSITIVITY OF SPACE SHUTTLE TILE MATERIALS
J. C. Newman, Jr. Jul. 1980 17 p ref
(NASA-TM-81854) Avail: NTIS HC A02/MF A01 CSCL 20K

Tests were conducted at room temperature to determine the notch sensitivity of the thermal protection tile for the space shuttle. Two types of RSI tile were studied: LI-900 and LI-2200. Three point bend specimens were cut from discarded tiles in the in-plane (ip) and through-the-thickness (ttt) directions. They were tested with or without a sharp notch. The LI-900 (ip and ttt) specimens were not very notch sensitive, but the LI-2200 (ip and ttt) specimens were. The LI-2200 material showed about a 35 percent reduction in strength due to the presence of the notch. This reduction in strength should be considered in the design of mechanically fastened tile concepts. Author

N80-29764*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PHOTOELASTIC TESTS ON MODELS OF THERMAL PROTECTION SYSTEM FOR SPACE SHUTTLE ORBITER
R. Prabhakaran (Old Dominion Univ., Norfolk, Va.) and Paul A. Cooper Aug. 1980 18 p refs
(NASA-TM-81856) Avail: NTIS HC A02/MF A01 CSCL 20K

The thermal protection system (TPS) of the space shuttle orbiter vehicle, consisting of ceramic tile/adhesive/strain isolator pad/adhesive/aluminum substructure, was modeled photoelastically. A highly sensitive photoelastic material was used in the models to show the nature of the stress-transfer between the strain isolation pad (SIP) and the ceramic tile through the RTV-adhesive layer. Isochromatic fringe patterns were obtained for models subjected to tension and combined tension and bending. Tests indicated that the load-transfer between the SIP and the photoelastic material occurred at discrete locations causing stress concentrations in the photoelastic material. Stress concentration factors of the order of 1.9 were measured, but as the observed photoelastic response was an integrated effect through the model thickness, the local stress concentration factors at the SIP/tile interface could be even higher. Author

N80-29765*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUBSTRUCTURE PROCEDURE FOR INCLUDING TILE FLEXIBILITY IN STRESS ANALYSIS OF SHUTTLE THERMAL PROTECTION SYSTEM
Gary L. Giles Aug. 1980 12 p refs
(NASA-TM-81864) Avail: NTIS HC A02/MF A01 CSCL 20K

A substructure procedure to include the flexibility of the tile in the stress analysis of the shuttle thermal protection system (TPS) is described. In this procedure, the TPS is divided into substructures of (1) the tile which is modeled by linear finite elements and (2) the SIP which is modeled as a nonlinear continuum. This procedure was applied for loading cases of uniform pressure, uniform moment, and an aerodynamic shock on various tile thicknesses. The ratios of through-the-thickness stresses in the SIP which were calculated using a flexible tile compared to using a rigid tile were found to be less than 1.05 for the cases considered. Author

N80-29766*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME SPACE SHUTTLE TILE/STRAIN-ISOLATOR-PAD SINUSOIDAL VIBRATION TESTS
Robert Miserentino, Larry D. Pinson, and Sumner A. Leadbetter Jul. 1980 27 p refs
(NASA-TM-81853) Avail: NTIS HC A03/MF A01 CSCL 20K

Vibration tests were performed on the tile/strain-isolator-pad system used as thermal protection for the space shuttle orbiter.

Experimental data on normal and in-plane vibration response and damping properties are presented. Three test specimens exhibited shear type motion during failures that occurred in the tile near the tile/strain-isolator-pad bond-line. A dynamic instability is described which has large in-plane motion at a frequency one-half that of the nominal driving frequency. Analysis shows that this phenomenon is a parametric response. Author

N80-29767*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF FULLY STRESSED DESIGN PROCEDURES TO REDUNDANT AND NON-ISOTROPIC STRUCTURES
Howard M. Adelman, Raphael T. Haftka, and Uri Tsach Jul. 1980 35 p refs
(NASA-TM-81842) Avail: NTIS HC A03/MF A01 CSCL 20K

An evaluation is presented of fully stressed design procedures for sizing highly redundant structures including structures made of composite materials. The evaluation is carried out by sizing three structures: a simple box beam of either composite or metal construction; a low aspect ratio titanium wing; and a titanium arrow wing for a conceptual supersonic cruise aircraft. All three structures are sized by ordinary fully-stressed design (FSD) and thermal fully stressed design (TFSD) for combined mechanical and thermal loads. Where possible, designs are checked by applying rigorous mathematical programming techniques to the structures. It is found that FSD and TFSD produce optimum designs for the metal box beam, but produce highly non-optimum designs for the composite box beam. Results from the delta wing and arrow wing indicate that FSD and TFSD exhibits slow convergence for highly redundant metal structures. Further, TFSD exhibits slow oscillatory convergence behavior for the arrow wing for very high temperatures. In all cases where FSD and TFSD perform poorly either in obtaining nonoptimum designs or in converging slowly, the assumptions on which the algorithms are based are grossly violated. The use of scaling, however, is found to be very effective in obtaining fast convergence and efficiently produces safe designs even for those cases when FSD and TFSD alone are ineffective. Author

N80-29768*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF SUBSTRATE DEFORMATION AND SIP THICKNESS ON TILE/SIP INTERFACE STRESSES FOR SHUTTLE THERMAL PROTECTION
Charles P. Shore and Ramon Garcia Jul. 1980 21 p refs
(NASA-TM-81855) Avail: NTIS HC A02/MF A01 CSCL 20K

A nonlinear analysis was used to study the effects of substrate deformation characteristics and strain isolator pad (SIP) thickness on TILE/SIP interface stresses for the space shuttle thermal protection system. The configuration analyzed consisted of a 5.08 cm thick, 15.24 cm square tile with a 12.7 cm square SIP footprint bordered by a 1.27 cm wide filler bar and was subjected to forces and moments representative of a 20.7 kPa aerodynamic shock passing over the tile. The SIP stress deflection curves were obtained after a 69 kPa proof load and 100 cycles conditioning at 55 kPa. The TILE/SIP interface stresses increase over flat substrate values for zero to peak substrate deformation amplitudes up to 0.191 cm by up to a factor of nearly five depending on deformation amplitude, half wave length, and location. Stresses for a 0.23 cm thick SIP found to be up to 60 percent greater than for a 0.41 cm thick SIP for identical loads and substrate deformation characteristics. A simplified method was developed for approximating the substrate location which produces maximum TILE/SIP interface stresses. E.D.K.

N80-29769# Naval Postgraduate School, Monterey, Calif.
ON COMBINATIONS OF RANDOM LOADS
D. P. Gaver and D. A. Jacobs Jan. 1980 51 p refs
(AD-A085489; NPS55-80-006) Avail: NTIS HC A04/MF A01 CSCL 13/13

Structures are subject to changing loads from various sources. In many instances these loads fluctuate in time in an apparently random fashion. Certain loads vary rather slowly (called constant loads); other loads occur more nearly as impulses (shock loads). Suppose that the stress put on the structure by various loads acting simultaneously can be expressed as a linear combination of the load magnitudes. In this paper certain simple but somewhat realistic probabilistic load models are given and the resulting probabilistic model of the total stress on the structure caused by the loads is considered. The distribution of the first time until the stress on the structure exceeds a given level x, and the distribution of the maximum stress put on the structure during the time interval (0,t) are studied. Asymptotic properties are also given. It is shown that the asymptotic properties of the maximum stress are related to those of the maxima of a sequence of dependent random variables. Classical extreme value type results are derived under proper normalization. GRA

N80-29770# Army Materials and Mechanics Research Center, Watertown, Mass. Process Development Div.
ON ADIABATIC SHEAR BAND DETERMINATIONS BY SURFACE OBSERVATIONS Final Report
Michael R. Staker Mar. 1980 12 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A085627; AMMRC-TR-80-6) Avail: NTIS HC A02/MF A01 CSCL 11/6

Two cracking mechanisms, adiabatic shear band cracking and ductile dimpled shear cracking, have been observed in hollow, right circular cylinders of AISI 4340 steel, which were explosively expanded in a quick-stop containment apparatus. It is concluded that distinction of cracking mechanisms cannot be made without the use of metallographic sectioning, as the external appearances of both types of cracks are identical. These exploding cylinder results demonstrate the inaccuracies associated with determining the presence or density of adiabatic shear bands only from surface observations. GRA

N80-29771# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapons Systems Lab.
A WIDE RANGE K EXPRESSION FOR THE C-SHAPED SPECIMEN
J. A. Kapp, J. C. Newman, and J. H. Underwood Mar. 1980 20 p refs Presented to ASTM Taskgroup E24.01.05, Pittsburgh, 30 Oct. 1979 Submitted for publication
(AD-A085719; AD-E440068) Avail: NTIS HC A02/MF A01 CSCL 11/6

A new expression has been developed to calculate K for the C-shaped specimen over a wider range of specimen parameters, namely a/W, X/W, and r sub 1/r sub 2 than had previously been available. The rationale used to derive the expression was to utilize known stress intensity factor solutions for short and deep cracks to develop a nondimensional form of K which approaches finite values as a/W goes to both zero and one. Numerical K solution results from prior work were then nondimensionalized to this form with the finite limiting values, and the dependent of K on a/W was determined by multi-variable, linear regression. The final expression agrees with the numerical K solutions within plus or minus 1.0% for .45 less than or equal to a/W less than or equal to .55 for all r sub 1/r sub 2 and X/W of either 0 or .5; within plus or minus 1.5% for .2 less than or equal to a/W less than or equal to 1 for all r sub 1/r sub 2 and X/W equal to 0 or .5; and within about plus or minus 3% for .2 less than or equal to a/W less than or equal to 1 for all r sub 1/r sub 2 and 0 less than or equal to X/W less than or equal to 1. The accuracy of this expression will allow expanded use of the C-shaped specimen for R-curve determination and fatigue crack growth rate tests. GRA

N80-29772# Aeronautical Research Associates of Princeton, Inc., N. J.
A CONTINUUM THEORY OF EQUILIBRIUM OF IRREVERSIBLE PROCESSES IN SOLIDS Final Report, 15 Apr. 1976 - 31 Jan. 1979
Thomas B. McDonough Jan. 1979 106 p refs
(Contract N00014-76-C-0809)
(AD-A085800; ARAP-395) Avail: NTIS HC A06/MF A01 CSCL 20/11

A theory is presented to describe the coupled thermal and mechanical behavior of solids which exhibit irreversibility. The developments presented are restricted to definitions and analyses of 'equilibrium states'. The foundations of the theory embody the following assumptions: (1) the local equilbrium state is fully

characterized by three state variables - i.e., the deformation gradient, the entropy density, and a substate variable, (2) a caloric equation of state and stress and temperature relations exist, (3) there is a bounded stable equilibrium region in state-space, (4) a stable equilibrium state satisfies a statement of static stability, and (5) an 'equilibrium process' may be represented by a continuous path in the stable equilibrium region. The meaning of 'equilibrium state' is clarified by considering global (static) stability. Two types are defined and analyzed: Global Adiabatic Stability and Global Adiabatic Mechanical Stability with Fixed Boundary. An equivalence between the latter and the definition of equilibrium state is proven. Several ideas for the further development of this theory are discussed in the concluding section. GRA

N80-29773# Missouri Univ. -Rolla. Dept. of Engineering Mechanics.

RESPONSE OF NONLINEAR STRUCTURAL PANELS SUBJECTED TO HIGH INTENSITY NOISE Final Report, 18 Jun. - 20 Aug. 1979

Chuh Mei (Old Dominion Univ., Norfolk, Va.) Wright-Patterson AFB, Ohio AFWAL Mar. 1980 56 p refs

(Contract F49620-79-C-0169; AF Proj. 2401)

(AD-A085638; AFWAL-TR-80-3018) Avail: NTIS HC A04/MF A01 CSCL 20/11

Lightweight aircraft structures exposed to a high intensity noise environment can fatigue fail prematurely if adequate consideration is not given to the problem. Design methods and design criteria for sonic fatigue prevention have been developed based on analytical and experimental techniques. Most of the analytical work was based upon small deflection or linear structural theory which did not agree with the experimental results. A large deflection geometrical nonlinearity was incorporated into the analysis methods for determing the structural response to high intensity noise. Using the Karman-Herrman large deflection equations for rectangular plates, a single mode Galerkin approximation, the nonlinear differential equations of motion were obtained. The method of equivalent linearization was used to solve the nonlinear equations for mean square displacement, mean square stresses and nonlinear frequencies at various acoustic loadings for rectangular panels. Comparisons with experimental results are presented. The results obtained agreed with the experimental results however, additional test data are needed for an adequate quantitative comparison. GRA

N80-29774# Maryland Univ., College Park. Dept. of Aerospace Engineering.

AN EXTENDED METHOD SOLUTION FOR A PULSE LOADED THIN PLATE Interim Report

Bruce K. Donaldson and N. B. Starkey Apr. 1980 12 p refs (Contract N00014-76-C-0872)

(AD-A085649; AE-80-1) Avail: NTIS HC A02/MF A01 CSCL 20/3

This paper deals with a new extension of a weighted residual method of analysis called the extended field method. The extended field method is applied for the first time to the problem of the transient vibration of a uniformly thin elastic plate. Numerical results have been obtained which validate the analysis procedure and show better solution convergence than is obtainable by standard methods of analysis for the same number of degrees of freedom. Further studies are necessary to obtain still better convergence. GRA

N80-29775# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

STRESS ANALYSES OF OD NOTCHED THICK-WALLED CYLINDERS SUBJECTED TO INTERNAL PRESSURE OR THERMAL LOADS

J. A. Kapp and G. A. Pelegl Feb. 1980 49 p refs

(DA Proj. 1L1-61102-AH-42)

(AD-A086110; AD-E440069; ARLCB-TR-80005) Avail: NTIS HC A03/MF A01 CSCL 20/11

Finite element stress analysis has been performed to determine the effects of two OD notch configurations in a cylinder subjected to internal pressure, or containing autofrettage residual stress. The effects on the residual stresses were determined by simulating these stresses with active temperature loads. The results show that the deeper of the two notch configurations is far more severe resulting in a maximum stress concentration factor of 2.9. The shallower notch has a maximum stress concentration factor of 2.0. An additional result is that by introducing notches in autofrettaged cylinders a significant amount of the residual stresses are relieved which indicates that smaller applied pressures can be contained by these cylinders, than in smooth cylinders before yielding occurs. The results also show that the possibility of OD initiated fatigue failure is greatly increased. GRA

N80-29776# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Aeronautical and Astronautical Engineering.

FINITE ELEMENT METHOD OF STRESS ANALYSIS OF NONAXISYMMETRIC CONFIGURATIONS Final Report, Mar. 1978 - Dec. 1978

Adam R. Zak and James N. Craddock Apr. 1980 140 p refs (Contract DAAD05-76-C-0743)

(AD-A086113; AD-E430467; ARBRL-CR-00423) Avail: NTIS HC A07/MF A01 CSCL 20/11

A finite element method of analysis is developed for structural configurations which are derived from axisymmetric geometries but contain definite nonaxisymmetric features in the circumferential direction. The purpose of the present analysis is to develop a method which will take into consideration the fact that the stress and strain conditions in these geometries will be related to the corresponding axisymmetric solution. The analysis is developed in terms of a cylindrical coordinate system r, phi, and z. As the first step of the analysis, the geometry is divided into several segments in the r-phi plane. Each segment is then divided into a set of quadrilateral elements in the r-z plane. The axisymmetric displacements are obtained for each segment by solving a related axisymmetric configuration. A perturbation analysis is then performed to match the solutions at certain points between the segments, and obtain the perturbation displacements for the total structure. The total displacement is then the axisymmetric displacement plus the perturbation displacement. The stresses and strains are then calculated at any desired point once the total displacements are known. The method is then applied to several examples to illustrate the accuracy of the method. The method of analysis is developed in two versions. The first version is for elastic, orthotropic materials. The second method is for elastic-plastic materials with a kinematic strain hardening model. As in the case of the elastic version, the second version also allows for orthotropic properties and the yield criterion is based on the Hill's yield function which reduces in the limit to von Mises-Hencky for isotropic materials. GRA

N80-29777# California Univ., Los Angeles. Dept. of Materials.

ACOUSTIC EMISSION ARISING FROM PLASTIC DEFORMATION AND FRACTURE

Kanji Ono May 1980 42 p refs Presented at the Joint Meeting of ASA and ASJ, Spec. Session of Acoustic Emission, Honolulu, Hawaii, 1 Dec. 1978

(Contract N00014-75-C-0419)

(AD-A086263; TR-80-02) Avail: NTIS HC A03/MF A01 CSCL 20/11

This paper reviews current status of acoustic emission signal detection methods, theoretical analysis of acoustic emission sources and acoustic emission behavior of materials arising from plastic deformation and fracture. Recent developments in quantitative signal detection and transducer characterization are considered. Several theories of acoustic emission sources are summarized and one based on dislocation theory by Malen and Bolin is extended to provide a relation between the inelastic displacement at a source to the peak voltage output of a resonant transducer. Models of acoustic emission from plastic deformation are presented. A new model for continuous acoustic emission is developed on the basis of the modified Malen-Bolin theory. Predictions of the model are discussed in conjunction with recent studies on acoustic emission behavior as a function of test temperature and of heat treatment. Finally, acoustic emission due to cracking is evaluated, especially in relation to amplitude distribution analysis of burst-type emission. GRA

N80-29778# Brown Univ., Providence, R. I. Dept. of Engineering.
COMPARISON OF EXPERIMENT AND THEORY FOR ELASTIC-PLASTIC PLANE STRAIN CRACK GROWTH
L. Hermann and J. R. Rice Feb. 1980 39 p refs Presented at the Conf. on Micromech. of Crack Extension, Cambridge, England, 31 Mar. 1980 Submitted for publication
(Contract EY-76-S-02-3084)
(CDO-3084-76; CONF-800358-1) Avail: NTIS HC A03/MF A01

Recent theoretical results on elastic-plastic plane strain crack growth and experimental results for crack growth in a 4140 steel in terms of the theoretical concepts are reviewed. The theory is based on a recent asymptotic analysis of crack surface opening and strain distributions at a quasi-statically advancing crack tip in an ideally plastic solid. The analysis is incomplete in that some of the parameters which appear in it are known only approximately, especially at large scale yielding. Nevertheless, it suffices to derive a relation between the imposed loading and amount of crack growth, prior to general yielding, based on the assumption that a geometrically similar near tip crack profile is maintained during growth. The resulting predictions for the variation of J with crack growth are found to fit well to the experimental results obtained on deeply cracked compact specimens. DOE

N80-29779# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik.
MECHANICAL AND PLASTIC BEHAVIOR IN CASE OF RUPTURE [MECHANIK UND STOFFVERHALTEN BEI BRUCHVORGAENGEN]
J. H. Argyris, W. Aicher, J. Doltsinis, H. J. Ertelt, G. Kiemer, and K. A. Schneider 1979 141 p refs In GERMAN
(Contract DFG-AR-44/31)
(ISD-257; ISSN-0170-6071) Avail: NTIS HC A07/MF A01

Analytical work on nonlinear rupture mechanics is presented. Experiments, techniques of measurement of extension, the measurement on a specimen with rupture, and the behavior of the material in case of stationary and nonstationary fracture extension are shown. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N80-29780*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USER DOCUMENTATION EOD-LARSYS EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM
R. T. Minter, B. E. Wills, and C. T. Gardner, Principle Investigator Jul. 1977 521 p refs Revised ERTS
(Contract NAS9-15200)
(E80-10188; NASA-CR-160617; LEC-3984-Rev-4; JSC-12504-Rev-4) Avail: NTIS HC A22/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29781*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT DESIGN SPECIFICATION FOR METRO DATA EDIT PROGRAM
E. L. Wilson, Principal Investigator Dec. 1976 43 p ERTS
(Contract NAS9-15200)
(E80-10201; NASA-CR-160620; LEC-9888; JSC-11838) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29782*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAM/CAS INTERFACE TAPE REPORT GENERATION PROGRAM FOR LACIE 7
K. P. Eckel, Principal Investigator Mar. 1978 123 p ERTS
(Contract NAS9-15200)
(E80-10203; NASA-CR-160629; LEC-12022; JSC-13917; LEC-11292) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29783*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAMS/CAS INTERFACE TAPE REPORT GENERATION PROGRAM
W. A. Holley, Principal Investigator Feb. 1977 69 p ERTS
(Contract NAS9-15200)
(E80-10204; NASA-CR-160619; LEC-9882; JSC-12560) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29784*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR SECONDARY ERROR SOURCES MULTI-TEMPORAL BAYES CLASSIFIER
P. J. Aucoin, Jr., Principal Investigator Dec. 1977 13 p ERTS
(Contract NAS9-15200)
(E80-10205; NASA-CR-160636; LEC-11677; JSC-13823) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29785*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR EQUIPROBABLE BLOCKS DENSITY ESTIMATORY/CLASSIFIER/DOT SELECTOR
P. J. Aucoin, Jr., Principal Investigator Dec. 1977 19 p ERTS
(Contract NAS9-15200)
(E80-10206; NASA-CR-160637; LEC-11676; JSC-13824) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29786*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CAMS IMAGE-100 HYBRID SYSTEM. VOLUME 1: SYSTEM DESIGN
L. E. Giddings, Principal Investigator Aug. 1977 322 p ERTS 2 Vol.
(Contract NAS9-15200)
(E80-10207; NASA-CR-160644; LEC-10822-Vol-1; JSC-13030-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29787*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE CAMS IMAGE-100 HYBRID SYSTEM. VOLUME 2: DETAILED FLOW CHARTS AND PROGRAM LISTINGS
L. E. Giddings, Principal Investigator Aug. 1977 397 p ERTS 2 Vol.
(Contract NAS9-15200)
(E80-10208; NASA-CR-160683; LEC-10822-Vol-2-Pt-2; JSC-13030-Vol-2-Pt-2) Avail: NTIS HC A17/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-29788*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT SPECIFICATION FOR CCIT7 PROCESSOR PROGRAM
W. P. White, Principal Investigator Nov. 1978 64 p ERTS
(Contract NAS9-15200)
(E80-10209; NASA-CR-160598; LEC-12518; JSC-14554)
Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29789*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FINAL DESIGN SPECIFICATION FOR LARSYS MODIFICATION/FISHER F-DISTRIBUTION THRESHOLDING
R. M. Rodriguez, Principal Investigator Dec. 1976 61 p ERTS
(Contract NAS9-15200)
(E80-10210; NASA-CR-160648; LEC-9963; JSC-11864) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29790*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FINAL DESIGN SPECIFICATION FOR EOD-LARSYS/DATA TRANSFORMATION PROCESSOR MODIFICATION
J. K. Rowland, Principal Investigator Apr. 1977 112 p ERTS
(Contract NAS9-15200)
(E80-10211; NASA-CR-160678; LEC-10662; JSC-12917)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29791*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FINAL DESIGN SPECIFICATION FOR EOD-LARSYS PROCEDURE 1 FOLLOW-ON
P. J. Aucoin, Jr., Principal Investigator Dec. 1977 44 p ERTS
(Contract NAS9-15200)
(E80-10213; NASA-CR-160635; LEC-11618; JSC-13817)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29792*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION: AS-BUILT DESIGN SPECIFICATION FOR GENERALIZED LINEAR MODEL ANALYSIS OF VARIANCE PROGRAM (GLMAOV)
Jeannie S. Gor, Principal Investigator Mar. 1978 57 p ERTS
(Contract NAS9-15200)
(E80-10214; NASA-CR-160649; LEX-12085; JSC-13945)
Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29793*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR LACIE FORMATTED DOT CARDS IN EOD-LARSYS
P. J. Aucoin, Jr. and Jeannie S. Gor, Principal Investigators Dec. 1977 14 p ERTS
(Contract NAS9-15200)
(E80-10215; NASA-CR-160639; LEC-11703; JSC-13837)
Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29794*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR BOUNDARY DETECTION AND REGISTRATION PROGRAM (BDARP1)
D. P. McKay and F. Collen, Principal Investigators Aug. 1977 116 p ERTS
(Contract NAS9-15200)
(E80-10217; NASA-CR-160621; LEC-11074; JSC-13055)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29795*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE YIELD ESTIMATION SUBSYSTEM (YES) MONTHLY YIELD DATA BASE AND SUPPORTING PROGRAMS
D. Cook and C. Siemons, Principal Investigators Feb. 1977 124 p ERTS
(Contract NAS9-15200)
(E80-10218; NASA-CR-160641; LEC-10034; JSC-12537)
Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29796*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION: MARQUIS2.FTN
Maury A. Mendlowitz, Principal Investigator Dec. 1977 26 p ERTS
(Contract NAS9-15200)
(E80-10220; NASA-CR-160622; LEC-11092; JSC-13145)
Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29797*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
OPERATIONAL CHANGES FOR THE KANSAS STATE UNIVERSITY WHEAT MODEL
R. L. Davenport, Principal Investigator Dec. 1977 30 p ERTS
(Contract NAS9-15200)
(E80-10223; NASA-CR-160633; LEC-11393; JSC-13813)
Avail: NTIS HC A03/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-29798*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Oct. - Dec. 1979
Helen N. Paley, Anne B. Kahle, and Stuart E. Matsh, Principal Investigators May 1980 4 p HCMM
(Contract NAS7-100)
(E80-10229; NASA-CR-163334) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29799*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, Mar. - May 1980
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Jun. 1980 5 p Sponsored by NASA HCMM
(E80-10230; NASA-CR-163335) Avail: NTIS HC A02/MF A01 CSCL 08B
The author has identified the following significant results. Two night-time thermal images of the Powder River Basin, Wyoming distinctly show a major thermal feature. This feature is substantially coincident with a drainage divide and the southward facing slope appears cooler, suggesting a lower thermal inertia. An initial examination of regional geologic maps provides no clear evidence to suggest what type of geologic feature or structure may be present, although it can be noted that its northeastern end passes directly through Lead, South Dakota where the Homestake Gold Mine is located.

N80-29800*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jan. - Mar. 1980

Helen N. Paley and Anne B. Kahle, Principal Investigators May 1980 4 p HCMM
(Contract NAS7-100)
(E80-10231; NASA-CR-163336) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29801*# Eastman Kodak Co., Rochester, N. Y.
ADVANCED SOLID STATE EARTH RESOURCES SATELLITE STUDY Final Report
30 Jun. 1980 70 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NASw-3375)
(E80-10232; NASA-CR-163337; RC-00221) Avail: NTIS HC A04/MF A01 CSCL 22B
There are no author-identified significant results in this report.

N80-29802*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON STIMULATING OPERATIONAL PRIVATE SECTOR USE OF EARTH OBSERVATION SATELLITE DATA Technical Progress Status Report, 15 Jan. - 15 Jun. 1980
Lester F. Eastwood, Jr., Jerry Foshage, Guillermo Gomez, Becky Kirkpatrick, Barry Konig, Bret Smith, Robert Stein, Francis Vithayathil, and Katherine Warner, Principal Investigators 15 Jun. 1980 125 p refs ERTS
(Contract NASw-3331)
(E80-10233; NASA-CR-163338) Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-indentified significant results in this report.

N80-29803*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR A MERGING PROGRAM FOR FORMATTED IMAGE DATA FILES
P. J. Aucoin, Jr., Principal Investigator May 1978 32 p ERTS
(Contract NAS9-15200)
(E80-10234; NASA-CR-160714; LEC-12373; JSC-14289) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29804*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF TOTAL DRY-MATTER ACCUMULATION IN WINTER WHEAT
Compton J. Tucker, Brent N. Holben, James H. Elgin, Jr. (Agricultural Research Center, Beltsville, Md.), and James E. McMurtrey, III, Principal Investigators (Agricultural Research Center, Beltsville, Md.) Jan. 1980 28 p refs Submitted for publication ERTS
(E80-10235; NASA-TM-80631) Avail: NTIS HC A03/MF A01 CSCL 02C
The author has identified the following significant results. Red and photographic-infrared spectral data collected on 21 dates over the growing season with a hand-held radiometer was quantitatively correlated with total dry-matter accumulation in winter wheat. The spectral data were found to be highly related to vigor and condition of the plant canopy. Two periods of drought stress and subsequent recovery from it were readily apparent in the spectral data. Simple ratios of the spectral data compensated for variations in solar intensities and, when integrated over the growing season, explained 79% of the variation in total above-ground accumulation of dry matter.

N80-29805*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
USER MANUAL FOR THE EARTH OBSERVATIONS DIVISION R AND D TO OLPARS DOT DATA CONVERSION
R. Nugent, Principal Investigator Apr. 1980 30 p refs ERTS
(Contract NAS9-15800)
(E80-10236; NASA-CR-160666; LEMSCO-14848; JSC-16665) Avail: NTIS HC A03/MF A01 CSCL 09B
There are no author-identified significant results in this report.

N80-29806*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
USE OF LANDSAT DATA FOR RIVER AND LAKE ICE ENGINEERING STUDIES
Dorothy K. Hall, Principal Investigator Apr. 1980 14 p refs Submitted for publication ERTS
(E80-10237; NASA-TM-80686) Avail: NTIS HC A02/MF A01 CSCL 08L
There are no author-identified significant results in this report.

N80-29807*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROJECT DEVELOPMENT PLAN FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
J. J. Carney and J. A. Vitallaro, Principal Investigators Oct. 1978 14 p ERTS
(Contract NAS9-15200)
(E80-10238; NASA-CR-160720; LEC-12856; JSC-14579) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29808*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEST PLAN FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
J. J. Carney and J. A. Vitallaro, Principal Investigators Oct. 1978 16 p ERTS
(Contract NAS9-15200)
(E80-10239; NASA-CR-160721; LEC-12857; JSC-14576) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29809*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PRELIMINARY DESIGN SPECIFICATION FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
J. M. Everette, D. K. McCarley, and K. P. Eckel, Principal Investigators Oct. 1978 43 p ERTS
(Contract NAS9-15200)
(E80-10240; NASA-CR-160719; LEC-12838; JSC-14577) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29810*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR AREAS ADDED TO THE MONTHLY BASES OF TEXAS, MINNESOTA AND USSR
K. Williams, Principal Investigator Mar. 1977 22 p ERTS
(Contract NAS9-15200)
(E80-10241; NASA-CR-160707; LEC-10353; JSC-12708) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29811*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT DESIGN SPECIFICATION FOR THE INDIA MONTHLY DATA BASE
K. Williams, Principal Investigator Feb. 1977 20 p ERTS
(Contract NAS9-15200)
(E80-10264; NASA-CR-160643; LEC-10253; JSC-12582) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29812*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR A LIST PROCESSING SYSTEM

C. L. Horton, C. W. Ahlers, and P. J. Aucoin, Jr. Aug. 1978 77 p ERTS
(Contract NAS9-15200)
(E80-10265; NASA-CR-160717; LEC-12696; JSC-14457) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29813*# Texas A&M Univ., College Station. Remote Sensing Center.
DEVELOPMENT AND EVALUATION OF SCATTEROMETER DATA PROCESSING ALGORITHMS Final Report
Richard W. Newton, Principal Investigator and Billy V. Clark Aug. 1979 153 p refs ERTS
(Contract NAS9-14875)
(E80-10266; NASA-CR-160577; RSC-3337) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29814*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PIXEL LABELING BY SUPERVISED PROBABILISTIC RELAXATION
D. A. Landgrebe, Principal Investigator, J. A. Richards, and P. H. Swain Feb. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10267; NASA-CR-160697; SR-PO-00454; LARS-022580) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-29815*# California Univ., Santa Barbara.
USE OF COLLATERAL INFORMATION TO IMPROVE LANDSAT CLASSIFICATION ACCURACIES Semiannual Progress Report, Oct. 1979 - Mar. 1980
Alan H. Strahler and John E. Estes, Principal Investigators Mar. 1980 75 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NsG-2377)
(E80-10268; NASA-CR-163340) Avail: NTIS HC A04/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29816*# National Environmental Satellite Service, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 24 Jun. 1980 3 p Sponsored by NASA HCMM
(E80-10269; NASA-CR-163341) Avail: NTIS HC A02/MF A01 CSCL 08L
The author has identified the following significant results. The HCMM thermal data are useful for monitoring estuarine surface thermal patterns. Estuarine thermal patterns, are, under certain conditions, indicative of the surface tidal current circulation patterns. Under optimum conditions, estuaries as small as the Cooper River (i.e., approximately 100 sq km) can be monitored for tidal/thermal circulation patterns by HCMM-type IR sensors.

N80-29817*# Phoenix Corp., McLean, Va.
IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report
25 Jun. 1980 3 p ERTS
(Contract NAS5-25882)
(E80-10270; NASA-CR-163342; QR-3) Avail: NTIS HC A02/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N80-29818*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
IMPROVEMENT OF THE EARTH'S GRAVITY FIELD FROM TERRESTRIAL AND SATELLITE DATA Status Report No. 16, 1 Jan. 1979 - 30 Jun. 1980
Jul. 1980 5 p ERTS
(Grant NGR-36-008-161; OSURF Proj. 783210)
(E80-10271; NASA-CR-163343) Avail: NTIS HC A02/MF A01 CSCL 08E
There are no author-identified significant results in this report.

N80-29819*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
SAMPLING OF RECTANGULAR REGIONS
George Terrell, Principal Investigator Jun. 1980 16 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10272; NASA-CR-160730; SR-L0-00460; LEMSCO-14806; JSC-16362) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29820*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
SOME APPROACHES TO OPTIMAL CLUSTER LABELING OF AEROSPACE IMAGERY
C. B. Chittineni, Principal Investigator May 1980 56 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10273; NASA-CR-160690; SR-L0-00440; LEMSCO-14597; JSC-16355) Avail: NTIS HC A04/MF A01 CSCL 20C
There are no author-identified significant results in this report.

N80-29821*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
EOD SYSTEMS AND FACILITIES WORKLOAD REQUIREMENTS FORECAST
W. A. Stevens and J. A. Vitellaro, Principal Investigators Apr. 1977 175 p ERTS
(Contract NAS9-15200)
(E80-10277; NASA-CR-160708; LEC-10522; JSC-12881) Avail: NTIS HC A08/MF A01 CSCL 05A
There are no author-identified significant results in this report.

N80-29822*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A (HEAT CAPACITY MAPPING MISSION) Technical Report, 1 Oct. - 31 Dec. 1979
R. J. P. Lyon and A. E. Prelat, Principal Investigators 31 Dec. 1979 5 p HCMM
(Contract NAS5-24232)
(E80-10279; NASA-CR-163345) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N80-29823*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1979 - 31 May 1980
Ta Liang, Principal Investigator and Warren R. Philipson Jun. 1980 100 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-33-010-171)
(E80-10280; NASA-CR-163346) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-29824*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

COMPOSITION AND ASSEMBLY OF A SPECTRAL DATA BASE FOR CORN AND SOYBEAN MULTICROP SEGMENTS

M. H. Trenchard, M. L. Sestak, and M. C. Kinsler, Principal Investigators Jun. 1980 338 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10281; NASA-CR-160726; AR-10-00407; LEMSCO-14250; JSC-13723) Avail: NTIS HC A15/MF A01 CSCL 20C

There are no author-identified significant results in this report.

N80-29825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THEMATIC MAPPER STUDIES BAND CORRELATION ANALYSIS

Stephen G. Unger and Richard Kiang Apr. 1976 28 p

(NASA-TM-80716) Avail: NTIS HC A03/MF A01 CSCL 08B

Spectral data representative of thematic mapper candidate bands 1 and 3 to 7 were obtained by selecting appropriate combinations of bands from the JSC 24 channel multispectral scanner. Of all the bands assigned, only candidate bands 4 (.74 mu to .80 mu) and 5 (.80 mu to .91 mu) showed consistently high intercorrelation from region to region and time to time. This extremely high correlation persisted when looking at the composite data set in a multitemporal, multilocation domain. The GISS investigations lend positive confirmation to the hypothesis, that TM bands 4 and 5 are redundant. R.K.G.

N80-29826*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SEASAT. VOLUME 3: GROUND SYSTEMS Final Report

E. Pounder, ed. 15 Jun. 1980 200 p refs

(Contract NAS7-100)

(NASA-CR-163442; JPL-Pub-80-38-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05B

The Seasat Project was a feasibility demonstration of the use of orbital remote sensing for global ocean observation. The satellite was launched in June of 1978 and was operated successfully until October 1978. A massive electrical failure occurred in the power system, terminating the mission prematurely. The ground systems using during the mission life are discussed. Descriptions of the operating organization, the system elements, and the testing program are included. The various phases of the mission: launch and orbit insertion; cruise; and calibration are discussed. A special section is included on the orbit maneuver activites. Operations during the satellite failure are reviewed and summarized. R.K.G.

N80-29827*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SEASAT. VOLUME 4: ATTITUDE DETERMINATION Final Report

Alfred J. Treder 1 Jul. 1980 166 p refs

(Contract NAS7-100)

(NASA-CR-163943; JPL-Pub-80-38-Vol-4) Avail: NTIS HC A08/MF A01 CSCL 05B

The Seasat project was a feasibility demonstration of the use of orbital remote sensing for global ocean observation. The satellite was launched in June 1978 and was operated successfully until October 1978. A massive electrical failure occurred in the power system, terminating the mission prematurely. The actual implementation of the Seasat Attitude Determination system and the contents of the attitude data files generated by that system are documented. The deviations from plan caused by the anomalous Sun interference with horizon sensors, inflight calibration of Sun sensor head 2 alignment and horizon sensor biomass, estimation of yaw interpolation parameters, Sun and horizon sensor error sources, and yaw interpolation accuracy are included. Examples are given of flight attitude data from all modes of the Orbital Attitude Control System, of the ground processing effects on attitude data, and of cold cloud effects on pitch, and roll data. R.K.G.

N80-29828# Electromagnetic Systems Labs., Inc., Sunnyvale, Calif.

IMAGE TRANSFORMATION STUDY Semiannual Technical Report, 1 Oct. 1979 - 30 Apr. 1980

Robert Devich, F. Weinhaus, L. Martin, D. Collier, G. Kiremidjian, A. Silvestri, D. Mcguirk, B. Gleaton, and R. LaPadp 30 May 1980 75 p refs

(Contract MDA903-80-C-0108; ARPA Order 3954) (AD-A086070; ESL-PR339; SATR-1) Avail: NTIS HC A04/MF A01 CSCL 14/5

The purpose of the Image Transformation Study is to develop techniques for converting oblique aerial photography to the ground level viewing perspectives that would be seen by an observer as he moves around within the imaged area. This report documents the first six months of the investigation. GRA

N80-29829# Maryland Univ., College Park. Computer Vision Lab.

A METHOD FOR FINDING PAIRS OF ANTI-PARALLEL STRAIGHT LINES

Ann Scher, Michael Shneier, and Azriel Rosenfeld Dec. 1979 22 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206) (AD-A086086; TR-845) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method of pairing anti-parallel straight lines is presented and discussed. The pairing is based on the distance between the lines, the amount by which they overlap, and on whether or not other lines are interposed. Examples are shown of applying the method to high-resolution aerial photographs. Results indicate that cultural features such as roads and buildings can be extracted and that a significant reduction in the complexity of the image description can be obtained. GRA

N80-29830# Defense Mapping Agency Aerospace Center, St. Louis, Mo.

INTERACTIVE DIGITAL TERRAIN DATA DISPLAYS Interim Report, period ending 1 Mar. 1980

Richard A. Berg 25 Feb. 1980 12 p Presented at ACSM/ASP Natl. Convention, St. Louis, 14 Mar. 1980

(AD-A085940) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Defense Mapping Agency produces and maintains cartographic digital data bases in support of military flight simulation and aeronautical operations. These data bases include terrain elevations over various geographic areas, stored in grids of varying intervals. In order to have effective management of these digital data bases, it is necessary to display them quickly, in a format which permits human comprehension of the information. An Image Manipulation Station (IMS) has been developed for this purpose. It is a color display processor interfaced to a minicomputer, magnetic tape drive and disk storage device. The IMS reads digital terrain elevations from magnetic tape, manipulates the data with software and displays various images of the information. The programs generate an image with the general appearance of topographic relief. Shaded relief and anaglyph stereo views can be added to further enhance the image. Color views are also generated for analysis purposes. Because the data base and the displayed image are congruent, an analyst can point to a position in the image and display the corresponding terrain elevation values on a CRT terminal. The IMS satisfies quality control requirements in a timely and inexpensive way. It allows the analyst to view the digital data quickly and positively to ensure that a data tape generated for distribution to field users is complete, free of discontinuities and covers the required geographic area. GRA

N80-29831# North Dakota Water Resources Research Inst., Fargo.

PHYSICAL PROPERTIES OF SOIL MOISTURE Technical Completion Report, Jul. 1976 - Sep. 1979

James W. Harrell, Jr. and Francis L. Howell Dec. 1979 40 p refs Prepared in cooperation with North Dakota Univ., Grand Forks

(Contract DI-14-34-0001-8036)

(PB80-175367; W80-04606; OWRT-A-051-NDAK(3)) Avail: NTIS HC A03/MF A01 CSCL 08M

Proton nuclear magnetic resonance and diffusion coefficient measurements were used to study the mobility of sorbed water

in Na- and Ca-montmorillonite, Na- and Ca-hectorite, and untreated kaolin. The montmorillonite and hectorite were saturated by adding a two molar chloride salt solution of either Na or Ca followed by three cycles of shaking, centrifuging, and pouring off the supernatant. Two hydrating methods were used. In the first, samples were saturated and air dried while in the second, saturated samples were equilibrated at a fixed moisture tension. Sample measurements taken include relaxation rate, pulse gradient diffusion, and tritium diffusion. GRA

N80-29832# Geological Survey, Tallahassee, Fla. Water Resources Div.

EVALUATION OF REMOTE HYDROLOGIC DATA-ACQUISITION SYSTEMS, WEST-CENTRAL FLORIDA

J. F. Turner, Jr. and W. M. Woodham Feb. 1980 71 p refs (PB80-176951; USGS/WRD/WRI-80/020; USGS/WRI-79/102) Avail: NTIS HC A04/MF A01 CSCL 08H

An evaluation of the hydrologic applications of a land line and tow satellite data relay systems operated during 1977-78 in the Southwest Florida Water Management District is presented. These systems were tested to evaluate operational and reliability characteristics. Telephone lines were used to relay data in the land line system, and the Geostationary Operational Environmental Satellite (GOES) and were used in the satellite system. The land system was tested for a period of 15 months at a streamflow site. Accurate data were obtained 94 percent of the time during the period. Data losses were attributed to telephone line interference, low battery voltage, and vandalism. The GOES system was tested at a rainfall site for a 17 month period. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-29833 Centec Corp., Fort Lauderdale, Fla.

THE COATING INDUSTRY: ENERGY SAVINGS WITH VOLATILE ORGANIC COMPOUND EMISSION CONTROL

Washington, D.C. DOE 1979 111 p refs (TID-28706) Copyright. Avail: Issuing Activity

Technical and economic data are presented to enable engineers and managers in the coating industry to evaluate the energy-conservation opportunities for installation of solvent emission-control systems. Although the properties of the solvents vary considerably, the information will serve to improve the ability of the engineer to make quick estimations of energy savings, energy rates, economics, and performance of control systems and heat-recovery options. Emphasis is directed to a discussion of add-on devices, such as thermal and catalytic incineration. Extensive graphics and illustrations show energy use, and economics; these are supplemented by calculations to be used by each plant to determine site-specific data. Author

N80-29834* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NATURAL TURBULENCE ELECTRICAL POWER GENERATOR Patent

David C. Grana and Richard T. Wilem, inventors (to NASA) Issued 4 Mar. 1980 5 p Filed 3 Mar. 1978 Supersedes N78-22468 (16 - 13, p 1719) (NASA-Case-LAR-11551-1; US-Patent-4,191,893; US-Patent-App-SN-883090; US-Patent-Class-290-53; US-Patent-Class-310-30) Avail: US Patent and Trademark Office CSCL 10B

An energy conversion apparatus is disclosed in which a stator, fixed to a watertight housing, is coupled to a rotor by a helical spring which suspends the rotor from the housing. Natural turbulence of a fluid, such as water or air, causes acceleration of the housing, and hence, acceleration of the stator. Inertia of the rotor, coupled to the stator through the helical spring and the housing, causes relative motion, both longitudinal and rotational, between the stator and the rotor. The rotational motion between the rotor, and the stator is used to generate electrical current. Official Gazette of the U.S. Patent and Trademark Office

N80-29835* National Aeronautics and Space Administration. Pasadena Office, Calif.

INDUCED JUNCTION SOLAR CELL AND METHOD OF FABRICATION Patent

Joseph Maserjian (JPL), Shy Shiun Chern (JPL), and Seung P. Li, inventors (to NASA) (JPL) Issued 16 May 1978 9 p Filed 15 Jun. 1976 Sponsored by NASA (NASA-Case-NPO-13788-1; US-Patent-4,090,213; US-Patent-Appl-SN-696374; US-Patent-Class-357-30; US-Patent-Class-357-52; US-Patent-Class-357-91; US-Patent-CLass-148-1.5) Avail: US Patent and Trademark Office CSCL 10A

An induced junction solar cell is fabricated on a p-type silicon substrate by first diffusing a grid of criss-crossed current collecting n+ stripes and thermally growing a thin SiO2 film, and then, using silicon-rich chemical vapor deposition (CVD), producing a layer of SiO2 having inherent defects, such as silicon interstices, which function as deep traps for spontaneous positive charges. Ion implantation increases the stable positive charge distribution for a greater inversion layer in the p-type silicon near the surface. After etching through the oxide to parallel collecting stripes, a pattern of metal is produced consisting of a set of contact stripes over the exposed collecting stripes and a diamond shaped pattern which functions as a current collection bus. Then the reverse side is metallized.

Official Gazette of the U.S. Patent and Trademark Office

N80-29836 Florida Univ., Gainesville.

DEVICE PHYSICS FOR ENGINEERING DESIGN OF HEAVILY DOPED REGIONS IN pn-JUNCTION SILICON SOLAR CELLS Ph.D. Thesis

Muhammed Ayman Shibib 1979 203 p Avail: Univ. Microfilms Order No. 8016581

A quantitative study of the physical mechanism underlying the anomalously large recombination current experimentally observed in heavily doped regions of silicon pn-junction solar cells and bipolar transistors is presented. The study includes a comparison of theoretical predictions with a variety of experimental observations in heavily doped silicon and silicon devices. A major conclusion is that the simplest physical model that adequately describes the heavily doped regions must include Fermi-Dirac statistics, and phenomenological excess intrinsic carrier density (or deficit impurity concentration), Auger recombination in the bulk, and recombination at the surface. These mechanisms are incorporated in a first order model useful in the design of silicon pn-junction solar cells. The accuracy of the first order model is supported by comparing its results with the results of more detailed models and of a numerical analysis of the problem. Experimental data are presented that are consistent with the predictions of the first order model and of the numerical solution. Dissert. Abstr.

N80-29837 Stanford Univ., Calif.

MARKET PENETRATION OF ENERGY SUPPLY TECHNOLOGIES Ph.D. Thesis

Robert James Condap 1980 131 p Avail: Univ. Microfilms Order No. 8016814

Techniques to incorporate the concepts of profit-induced growth and risk aversion into policy-oriented optimization models of the domestic energy sector are examined. After reviewing the pertinent market penetration literature, simple mathematical programs in which the introduction of new energy technologies is constrained primarily by the reinvestment of profits are formulated. The main results involve the convergence behavior of technology production levels under various assumptions about the form of the energy demand function. Next, profitability growth constraints are embedded in a full-scale model of U.S. energy-economy interactions. A rapidly convergent algorithm is developed to utilize optimal shadow prices in the computation of profitability for individual technologies. Allowance is made for additional policy

variables such as government funding and taxation. The result is an optimal deployment schedule for current and future energy technologies which is consistent with the sector's ability to finance capacity expansion. Dissert. Abstr.

N80-29838# Booz-Allen and Hamilton, Inc., Bethesda, Md.
ALTERNATIVE METERING PRACTICES. IMPLICATIONS FOR CONSERVATION IN MULTIFAMILY RESIDENCES
Jun. 1979 222 p
(Contract EC-77-C-03-1693)
(HCP/M1693-03) Avail: NTIS HC A10/MF A01

Comparisons are made of utility bills in multifamily residences where master meters and individual meters are used. Empirical evidence indicates that tenants who are made financially responsible for the energy they use, as in cases with individual or submetering, will consume less energy than tenants in a master situation. For electricity, the average savings are 15 to 20 percent. For gas, the savings are significantly less. The long-term impact of prohibing master meters is analyzed with regard to energy conservation, cost, and development of alternative energy sources for multifamily dwellings. L.F.M.

N80-29839# Department of Energy, Washington, D. C. Energy Information Administration.
CHARACTERISTICS OF THE HOUSING STOCK AND HOUSEHOLDS: PRELIMINARY FINDINGS FROM THE NATIONAL INTERIM ENERGY CONSUMPTION SURVEY
1 Oct. 1979 52 p
Avail: NTIS HC A04/MF A01

Results from a national interim energy consumption survey designed to provide information related to energy consumption by the residential sector are presented. Information on energy use was collected at the household level. A representative (national) sample of households was selected in the 48 contiguous states plus the District of Columbia. The data on actual energy consumption was obtained from fuel records maintained by the household's fuel suppliers. Four sets of tables described the households and housing units including the general structural features of the units; household inventories of major appliances; heating equipment and the distribution of fuels used for space heating, water heating, and cooling; and socioeconomic characteristics. M.G.

N80-29840# Alaska State Div. of Energy and Power Development, Anchorage.
MINIMIZING CONSUMPTION OF EXHAUSTIBLE ENERGY RESOURCES THROUGH COMMUNITY PLANNING AND DESIGN. DEVELOPMENT OF PROCEDURES FOR APPLICATION DURING PUBLIC FACILITIES PROCUREMENT PROCESS. PHASE 2: EXTENSION Final Report
Feb. 1979 151 p
(Contract EX-76-C-08-2332)
(RLO-2332-3) Avail: NTIS HC A08/MF A01

The State of Alaska's Division of Energy and Power Development conducted a study of energy conservation measures that can be incorporated in public facilities and a new community such as that proposed for the State capital, should it be relocated. The process by which such facilities are procured was revised to incorporate analysis of energy conservation measures and the control of their incorporation. Supporting procedures were also developed. Author

N80-29841# Department of Energy, Washington, D. C.
STANDBY ENERGY CONSERVATION PLAN NO. 2: BUILDING TEMPERATURE RESTRICTIONS PLAN
Feb. 1980 47 p refs
(DOE/EV-0049/1) Avail: NTIS HC A03/MF A01

The environmental impacts of the proposed building temperature restrictions plan are analyzed. The plan would result in fuel and energy savings which could be diverted to other areas. Environmental impacts, with emphasis on air quality, were analyzed and found to result in a very minor improvement in air quality. Public health impacts are also minimal, and although some individuals may experience discomfort, it can be minimized by adjustments in clothing. The change in temperature is insufficient to have any significant impact on persons suffering from most diseases. A.R.H.

N80-29842*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE POWER SYSTEMS (SPS): CONCEPT DEVELOPMENT AND EVALUATION PROGRAM: PRELIMINARY ASSESSMENT
DOE Sep. 1979 19 p refs Sponsored by DOE
(NASA-TM-81142; DOE/ER-0041) Avail: NTIS HC A02/MF A01 CSCL 10A

A preliminary assessment of a potential Satellite Power System (SPS) is provided. The assessment includes discussion of technical and economic feasibility; the effects of microwave power transmission beams on biological, ecological, and electromagnetic systems; the impact of SPS construction, deployment, and operations on the biosphere and on society; and the merits of SPS compared to other future energy alternatives. L.F.M.

N80-29843*# National Aeronautics and Space Administration, Pasadena Office, Calif.
AUTOMOTIVE ABSORPTION AIR CONDITIONER UTILIZING SOLAR AND MOTOR WASTE HEAT Patent Application
Zenon Popinski, inventor (to NASA) (JPL) Filed 30 Jul. 1980 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15183; US-Patent-Appl-SN-173519) Avail: NTIS HC A02/MF A01 CSCL 10A

An absorption cycle air conditioning system for use as a space cooling system in an electrically powered motor vehicle is disclosed. The system is of a lightweight design and has a capability for achieving vehicular space cooling with minimal attendant power requirements. The system is adapted to utilize solar and motor waste heat. J.M.S.

N80-29844# National Aeronautical Lab., Bangalore (India).
A HORIZONTAL AXIS SAIL WINDMILL FOR USE IN IRRIGATION
S. K. Tewari, Ningaiah, D. V. V. Subramanyam, and A. C. Samraj Mar. 1979 22 p refs
(NAL-TN-54) Avail: NTIS HC A02/MF A01

Some basic considerations in the design and development of a horizontal axis windmill, intended primarily for irrigation in small farms from shallow open wells are described. This windmill has six triangular sails sweeping a circle of 10 meters in diameter, and is an adaptation from Greek sail windmills. For the construction of this windmill, all efforts are made to use materials and parts readily available in the hardware market except for the gear boxes. The cost of material and parts is approximately $900 which excludes cost of machining and fabrication charges. Preliminary performance tests indiate a pumping rate of 6000 to 11,000 liters/hour over a head of 6.85 meters in wind speeds of 10 to 16 km/hr. Author

N80-29845*# General Dynamics/Convair, San Diego, Calif.
STUDY OF POWER MANAGEMENT TECHNOLOGY FOR ORBITAL MULTI-100KWe APPLICATIONS. VOLUME 3: REQUIREMENTS
J. W. Midice 15 Jul. 1980 37 p refs 3 Vol.
(Contract NAS3-21757)
(NASA-CR-159834; GDC-ASP-80-015) Avail: NTIS HC A03/MF A01 CSCL 10B

Mid to late 1980's power management technology needs to support development of a general purpose space platform, capable of suplying 100 to 250 KWe to a variety of users in low Earth orbit are examined. A typical, shuttle assembled and supplied space platform is illustred, along with a group of payloads which might reasonably be expected to use such a facility. Examination of platform and user power needs yields a set of power requirements used to evaluate power management options for life cycle cost effectivness. The most cost effective ac/dc and dc systems are evaluated, specifically to develop system details which lead to technology goals, including: array and transmission voltages, best frequency for ac power transmission, and advantages and disadvantages of ac and dc systems for this application. System and component requirements are compared with the state-of-the-art to identify areas where technological development is required. Author

N80-29846*# Travis-Braun and Associates, Inc., Dallas, Tex.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT OFFICE BUILDING, ONE SOLAR PLACE, DALLAS, TEXAS Final Report
Jun. 1980 123 p
(Contract EG-77-A-01-4093)
(NASA-CR-161483) Avail: NTIS HC A06/MF A01 CSCL 10B

A solar heating on cooling system is described which is designed to provide 87 percent of the space heating needs, 100 percent of the potable hot water needs and is sized for future absorption cooling. The collection subsystem consists of 28 solargenics, series 76, flat plate collectors with a total area of 1,596 square feet. The solar loop circulates an ethylene glycol water solution through the collectors into a hot water system exchanger. The water storage subsystem consists of a heat exchanger, two 2,300 gallon concrete hot water storage tanks with built in heat exchangers and a back-up electric boiler. The domestic hot water subsystem sends hot water to the 10, 200 square feet floor area office building hot water water fixtures. The building cold water system provides make up to the solar loop, the heating loop, and the hot water concrete storage tanks. The design, construction, cost analysis, operation and maintenance of the solar system are described. R.C.T.

N80-29847*# Dallas Independent School District, Tex.
SOLAR HEATING AND DOMESTIC HOT WATER SYSTEM INSTALLED AT NORTH DALLAS HIGH SCHOOL Final Report
May 1980 106 p
(Contract EM-78-F-01-5204)
(NASA-CR-161482) Avail: NTIS HC A06/MF A01 CSCL 10B

The solar energy system located at the North Dallas High School, Dallas, Texas is discussed. The system is designed as a retrofit in a three story with basement, concrete frame high school building. Extracts from the site files, specification references for solar modification to existing building heating and domestic hot water systems, drawings, installation, operation and maintenance instructions are included. R.C.T.

N80-29848*# Citizens Mutual Savings and Loan Association, Leavenworth, Kans.
SOLAR HEATING AND COOLING SYSTEM INSTALLED AT LEAVENWORTH, KANSAS Final Report
Jun. 1980 318 p
(EM-78-F-01-5193)
(NASA-CR-161484) Avail: NTIS HC A14/MF A01 CSCL 10B

A solar heating and cooling is described which is designed to furnish 90 percent of the overall heating load, 70 percent of the cooling load and 100 percent of the domestic hot water load. The building has two floors with a total of 12,000 square feet gross area. The system has 120 flat-plate liquid solar panels with a net area of 2,200 square feet. Five 3 ton Arkla solar assisted absorption units provide the cooling, in conjunction with a 3,000 gallon chilled water storage tank. Two 3,000 gallon storage tanks are provided with one designated for summer use, whereas both tanks are utilized during winter. R.C.T.

N80-29849*# Stephens Coll., Columbia, Mo. Building and Grounds Dept.
SOLAR SPACE HEATING FOR THE VISITORS CENTER, STEPHENS COLLEGE, COLUMBIA, MISSOURI Final Report
Jun. 1980 310 p
(Contract EG-77-A-01-4084)
(NASA-CR-161485) Avail: NTIS HC A14/MF A01 CSCL 10B

The solar energy system located at the Visitors' Center on the Stephens College Campus, Columbia, Missouri is discussed. The system is installed in a four-story, 15,000 square foot building. The solar energy system is an integral design of the building and utilizes 176 hydronic flat plate collectors which use a 50 percent water ethylene blycol solution and water-to-water heat exchanger. Solar heated water is stored in a 5,000 gallon water storage tank located in the basement equipment room. A natural gas fired hot water boiler supplies hot water when the solar energy heat supply fails to meet the demand. The designed solar contribution is 71 percent of the heating load. R.C.T.

N80-29850*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. SEASONAL REPORT FOR COLT PUEBLO, PUEBLO, COLORADO Contractor Report, Feb. 1979 - Jan. 1980
Jun. 1980 93 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161493) Avail: NTIS HC A05/MF A01 CSCL 10B

The Colt-Pueblo solar energy system, designed to provide space heating and hot water preheating, is described and its operational performance for a 12 month period from February 1979 through January 1980 is evaluated. The space heating subsystem met 31 percent of the measured space heating load which was close to the expected 34 percent solar fraction. Although the hot water solar fraction was 79 percent, the overall energy saving capability was reduced because of the low hot water demand. The measured heating subsystem performance would have improved considerably if the uncontrolled losses primarily from transport piping could have been reduced to an inconsequencital level. Fossil energy savings of 70.31 million BTUs are estimated. L.F.M.

N80-29851*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION. SEASONAL REPORT FOR SEECO LINCOLN, LINCOLN, NEBRASKA Contractor Report, Apr. 1979 - Mar. 1980
Jun. 1980 71 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161495) Avail: NTIS HC A04/MF A01 CSCL 10B

The Solar Engineering and Equipment Company (SEECO) Lincoln solar energy system, designed for space heating only, is described and its operational performance for a 12 month period from April 1979 through March 1980 is evaluated. The system met 27 percent of the space heating load; however, system losses into the heated space from the storage bin and ductwork were significant. Reducing these losses would add appreciably to the system's efficiency. Net fossil energy savings were 11.31 million BTUs. L.F.M.

N80-29852*# Communications Satellite Corp., Clarksburg, Md.
THIN n-i-p RADIATION-RESISTANT SOLAR CELL FEASIBILITY STUDY Final Report
J. F. Allison, R. A. Arndt, and A. Meulenberg, Jr. Jun. 1980 70 p refs
(Contract NAS3-21280)
(NASA-CR-159871) Avail: NTIS HC A04/MF A01 CSCL 10A

Silicon solar cells were fabricated to verify the predictions that: (1) thin n(+)pp(+) cells can provide high values of open circuit voltage even when high resistivity base material (> 1000 omega-cm) is used; (2) cells with good p(+) back contacts will display an increase in open circuit voltage with decreasing cell thickness; and (3) high quality, thin, high resistivity, solar cells can be made using processing compatible with conventional practice. Analysis of I-V and spectral response measurements of these cells confirmed theoretical predictions and thereby pointed to voltages beyond the near 600 mV obtained in this study. Author

N80-29853*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR CONTEMPORARY NEWMAN, NEWMAN, GEORGIA Contractor Report, Jun. 1979 - Apr. 1980
Jun. 1980 80 p Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161494) Avail: NTIS HC A05/MF A01 CSCL 10A

A hot solar heating and hot water system's operational performance from June 1979 through April 1980 is evaluated. Solar energy satisfied 42 percent of the total measure load (hot water plus space heating), which was somewhat higher than the solar fraction of 32 percent. When system losses into the heating space from duct leaks and storage are included, the

heating solar fraction increases from 42 to 64 percent. Net electrical energy savings were 5.47 million BTUs. L.F.M.

N80-29854*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION: IBM SYSTEM 2, TOGUS, MAINE Final Report
Jul. 1980 95 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161510) Avail: NTIS HC A05/MF A01 CSCL 10A

The economic analysis of the solar energy system, is developed for Torgus and four other sites typical of a wide range of environmental and economic conditions in the continental United States. This analysis is accomplished based on the technical and economic models in the f-chart design procedure with inputs taken on the characteristics of the installed system and local conditions. The results are expressed in terms of the economic parameters of present worth of system cost over a projected twenty year life, life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. Results demonstrate that the solar energy system is economically viable at all of the five sites for which the analysis was conducted. Author

N80-29855*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR FERN LANSING, LANSING, MICHIGAN Contractor Report, Apr. 1979 - Mar. 1980
Jun. 1980 87 p Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161491) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar space heating and hot water system's operational performance from April 1979 through March 1980 is evaluated. Solar energy satisfied 15 percent of the total measured load (hot water plus space heating). Net savings were approximately 21 million BTUs. L.F.M.

N80-29856*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: SEASONAL REPORT FOR IBM SYSTEM 1B, CARLSBAD, NEW MEXICO Contractor Report, Apr. 1979 - Mar. 1980
Jul. 1980 75 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161508) Avail: NTIS HC A04/MF A01 CSCL 10A

A hot solar heating and hot water system's operational performance from April 1979 through March 1980 is evaluated. The space heating and hot water loads were near expected values for the year. Solar energy provided 43 percent of the space heating and 53 percent of the hot water energy. The system did not meet the total system solar fraction design value of 69 percent because of a combination of higher estimated space heating load than was actually encountered and the apportioning of solar energy between the space heating and the domestic hot water loads. System losses and high building temperatures also contributed to this deviation. Total net savings were 23,072 million BTUs. Most of the energy savings came during the winter months, but hot water savings were sufficient to justify running the system during the summer months. L.F.M.

N80-29857*# Honeywell, Inc., Minneapolis, Minn. Technology Strategy Center.
ACTIVE HEAT EXCHANGE SYSTEM DEVELOPMENT FOR LATENT HEAT THERMAL ENERGY STORAGE Final Report
R. T. LeFrois and A. K. Mathur Apr. 1980 226 p
(Contract DEN3-38)
(NASA-CR-159727; DOE/NASA/0038-80/2; HI-79188) Avail: NTIS HC A11/MF A01 CSCL 10C

Five tasks to select, design, fabricate, test and evaluate candidate active heat exchanger modules for future applications to solar and conventional utility power plants were discussed. Alternative mechanizations of active heat exchange concepts were analyzed for use with heat of fusion phase change materials (PCMs) in the temperature range of 250 to 350 C. Twenty-six heat exchange concepts were reviewed, and eight were selected for detailed assessment. Two candidates were selected for small-scale experimentation: a coated tube and shell heat exchanger and a direct contact reflux boiler. A dilute eutectic mixture of sodium nitrate and sodium hydroxide was selected as the PCM from over 50 candidate inorganic salt mixtures. Based on a salt screening process, eight major component salts were selected initially for further evaluation. The most attractive major components in the temperature range of 250 to 350 C appeared to be NaNO3, NaNO2, and NaOH. Sketches of the two active heat exchange concepts selected for test are given. R.K.G.

N80-29858*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Solar Thermal Power Systems.
ELECTROCHEMICAL ENERGY STORAGE SYSTEMS FOR SOLAR THERMAL APPLICATIONS
S. Krauthamer and H. Frank 1 Mar. 1980 119 p refs Revised
(Contracts NAS7-100; DE-AI01-79ET-20307)
(NASA-CR-163432; JPL-Pub-79-95-Rev-1; DOE/JPL-1060/30-Rev-1) Avail: NTIS HC A06/MF A01 CSCL 10C

Existing and advanced electrochemical storage and inversion/conversion systems that may be used with terrestrial solar-thermal power systems are evaluated. The status, cost and performance of existing storage systems are assessed, and the cost, performance, and availability of advanced systems are projected. A prime consideration is the cost of delivered energy from plants utilizing electrochemical storage. Results indicate that the five most attractive electrochemical storage systems are the: iron-chromium redox (NASA LeRC), zinc-bromine (Exxon), sodium-sulfur (Ford), sodium-sulfur (Dow), and zinc-chlorine (EDA). A.R.H.

N80-29859*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
URBAN SOLAR PHOTOVOLTAICS POTENTIAL: AN INVENTORY AND MODELLING STUDY APPLIED TO THE SAN FERNANDO VALLEY REGION OF LOS ANGELES
G. L. Angelici, N. A. Bryant, R. K. Freta, and S. Z. Friedman
15 Aug. 1980 47 p refs
(Contract NAS7-100)
(NASA-CR-163436; JPL-PUB-80-43) Avail: NTIS HC A03/MF A01 CSCL 10A

Procedures for analyzing the potential of solar photovoltaic collectors to meet energy requirements in a metropolitan region are described and a modeling effort is applied to the San Fernando Valley region of Los Angeles. The procedure involves a series of steps designed to produce maps and tabulations revealing the amount of rooftop area available for establishing solar collectors and the proportion of energy requirement that could be potentially supplied by solar photovoltaics within each of the 533 mainline feeder service areas in the study area. For the sixty five square mile study area, the results showed that, with half the available flat and south facing roofs used and assuming the availability of energy storage, 52.7 percent of the actual kWh energy requirements could have been met in 1978 using photovoltaic collectors. Hourly, daily, weekly, and monthly fluctuations in potential supply and actual loads and recommendations of avenues for further research are discussed. Some further potential applications of the modeling technique are suggested. Author

N80-29860*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Solar Thermal Power Systems.
HIGH TEMPERATURE THERMAL ENERGY STORAGE IN STEEL AND SAND
Robert H. Turner 15 Dec. 1979 93 p Sponsored by NASA and DOE
(NASA-CR-159708; DOE/NASA/0100-79/1; JPL-PUB-80-35) Avail: NTIS HC A05/MF A01 CSCL 10C

The technical and economic potential for high temperature (343 C, 650 F) thermal energy storage in hollow steel ingots, pipes embedded in concrete, and for pipes buried in sand was evaluated. Because it was determined that concrete would separate from pipes due to thermal stresses, concrete was replaced by sand, which is free from thermal stresses. Variations of the steel ingot concept were not cost effective compared to the

sand-pipe approach, therefore, the sand-pipe thermal storage unit (TSU) was evaluated in depth to assess the approximate tube spacing requirements consistent with different system performance characteristics and also attendant system costs. For large TSUs which do not require fast response times, the sand-pipe approach offers attractive possibilities. A pipe diameter about 9 cm (3.5 in) and pipe spacing of approximately 25 cm (10 in), with sand filling the interspaces, appears appropriate. Such a TSU system designed for 8 hours charge/discharge cycle has an energy unit storage cost (CE) of $2.63/kWhr-t and a power unit storage cost (Cp) of $42/kW-t (in 1977 dollars). A.R.H.

N80-29861*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

INTERGENERATIONAL EQUITY AND CONSERVATION

Richard P. Otoole and A. L. Walton 15 Jun. 1980 28 p refs (NASA-CR-163434; JPL-Pub-80-49) Avail: NTIS HC A03/MF A01 CSCL 10B

The issue of integenerational equity in the use of natural resources is discussed in the context of coal mining conversion. An attempt to determine if there is a clear-cut benefit to future generations in setting minimum coal extraction efficiency standards in mining is made. It is demonstrated that preserving fossil fuels beyond the economically efficient level is not necessarily beneficial to future generations even in terms of their own preferences. Setting fossil fuel conservation targets for intermediate products (i.e. energy) may increase the quantities of fossil fuels available to future generations and hence lower the costs, but there may be serious disadvantages to future generations as well. The use of relatively inexpensive fossil fuels in this generation may result in more infrastructure development and more knowledge production available to future generations. The value of fossil fuels versus these other endowments in the future depends on many factors which cannot possibly be evaluated at present. Since there is no idea of whether future generations are being helped or harmed, it is recommended that integenerational equity not be used as a factor in setting coal mine extraction efficiency standards, or in establishing requirements. R.K.G.

N80-29862*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RAPPORTEUR REPORT: MHD ELECTRIC POWER PLANTS

George R. Seikel 1980 17 p Presented at 7th Intern. Conf. on MHD Elec. Power Generation, Cambridge, Mass. 16-20 Jun. 1980

(Contract EF-77-A-01-2674)

(NASA-TM-81554; DOE/NASA/2674-12; E-516) Avail: NTIS HC A02/MF A01 CSCL 10B

Five US papers from the Proceedings of the Seventh International Conference on MHD Electrical Power Generation at the Massachusetts Institute of Technology are summarized. Results of the initial parametric phase of the US effort on the study of potential early commercial MHD plants are reported and aspects of the smaller commercial prototype plant termed the Engineering Test Facility are discussed. The alternative of using a disk geometry generator rather than a linear generator in baseload MHD plants is examined. Closed-cycle as well as open-cycle MHD plants are considered. A.R.H.

N80-29863*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GAS PHASE OXIDATION DOWNSTREAM OF A CATALYTIC COMBUSTOR

James S. Tien (Case Western Reserve Univ.) and David N. Anderson 1979 13 p refs Presented at 13th Middle Atlantic Regional Meeting of the ACS, West Long Branch, N.J., 19-23 Mar. 1979

(Contract EC-77-A-31-1040)

(NASA-TM-81551; DOE/NASA/1040-16; E-512) Avail: NTIS HC A02/MF A01 CSCL 10A

Effect of the length available for gas-phase reactions downstream of the catalytic reactor on the emission of CO and unburned hydrocarbons was investigated. A premixed, prevaporized propane/air feed to a 12/cm/diameter catalytic/reactor test section was used. The catalytic reactor was made of four 2.5 cm long monolithic catalyst elements. Four water cooled gas sampling probes were located at positions between 0 and 22 cm downstream of the catalytic reactor. Measurements of unburned hydrocarbon, CO, and CO2 were made. Tests were performed with an inlet air temperature of 800 K, a reference velocity of 10 m/s, pressures of 3 and 600,000 Pa, and fuel air equivalence ratios of 0.14 to 0.24. For very lean mixtures, hydrocarbon emissions were high and CO continued to be formed downstream of the catalytic reactor. At the highest equivalence ratios tested, hydrocarbon levels were much lower and CO was oxidized to CO2 in the gas phase downstream. To achieve acceptable emissions, a downstream region several times longer than the catalytic reactor could be required. R.K.G.

N80-29864# Army Construction Engineering Research Lab., Champaign, Ill.

INVESTIGATION OF METHODS TO PREDICT THERMAL STRATIFICATION AND ITS EFFECT ON SOLAR ENERGY SYSTEM PERFORMANCE

B. J. Sliwinski May 1980 33 p refs

(DA Proj. 4A7-61102-AT-23)

(AD-A086051; CERL-SR-E-160) Avail: NTIS HC A03/MF A01 CSCL 10/2

This report describes a study to identify characteristics which induce thermal stratification in liquid thermal storage, and to evaluate solar energy system performance as a function of the degree of stratification. It was determined that for efficient use of thermal stratification it was necessary to (1) introduce hot fluid at the top of the liquid storage tank to add cold fluid at the bottom of the tank, (2) with a cylindrical tank, have a length/diameter ratio equal to or greater than 2.0, (3) use mathematical correlations to determine allowable fluid inlet velocities and temperatures, and (4) use storage tank material that has a thermal conductivity less than that of the storage fluid. The mathematical correlations described in this report allow stratification occurrence to be predicted and can be used to estimate the sharpness of the thermocline based on tank inlet and outlet conditions, fluid properties, and storage tank geometry. GRA

N80-29865# Spire Corp., Bedford, Mass.

DEVELOPMENT OF RECRYSTALLIZATION AND THIN-FILM SOLAR CELL PROCESSES Final Report, 1 Oct. 1977 - 30 Sep. 1978

Stanley J. Solomon May 1979 148 p refs

(Contract EG-77-C-01-4106)

(DSE-4106-T4) Avail: NTIS HC A07/MF A01

The culmination of the recrystallization effort was demonstrating grains broader than the 30 micrometer film in which they were regrown. This proof of principle was accomplished by means of a two step thermal process that consisted of large area pulsed electron beam melting followed by small area heating in a moving dc electron beam. The pulsed beam treatment reduced the three dimensional disorder of the initial submicrometer crystallite silicon film to one characterized by submicrometer cross section, full film thickness, columnar crystallites. The swept beam treatment allowed coalescence of these columnar crystallites, through directional freezing, in the melt path of the beam. The results of the studies on junction formation in 3-5 materials show that low energy ion implantation is a potentially viable alternative to liquid or vapor phase epitaxy in the fabrication of GaAs solar cells. Further, the technical feasibility of pulsed electron beam activation of ion implanted junctions in GaAs was demonstrated. The concept of forming front-layer windows of GaP and AlGaAS on GaAS by high dose ion implantation is shown to be technically feasible. DOE

N80-29866# Sandia Labs., Albuquerque, N. Mex. Radiant Heat Div.

SANDIA LABORATORIES RADIANT HEAT FACILITY

P. H. Adams, J. T. Nakos, and B. G. Strait Feb. 1980 88 p refs

(Contract EY-76-C-04-0789)

(SAND-79-2182) Avail: NTIS HC A05/MF A01

The capabilities and limitations of the Radiant Heat Facility are described along with the two main types of testing equipment, i.e., quartz lamps and graphite resistor heater arrays. The data acquisition capabilities and instrumentation techniques are outlined, and a short discussion of the theory of radiation heat transfer is presented. DOE

N80-29867# Brookhaven National Lab., Upton, N. Y. Solar Technology Group.

GROUND COUPLED SOLAR HEAT PUMP RESEARCH PROGRAM IN THE UNITED STATES

Philip D. Metz 1980 5 p refs Presented at the 5th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 14-15 Apr. 1980

(Contract EY-76-C-02-0016)

(BNL-27383; CONF-800451-1) Avail: NTIS HC A02/MF A01

The ground coupling research program funded by the Systems Development Division of the Office of Solar Applications of the US Department of Energy studies the use of the Earth as a heat source/sink or storage element for solar heat pump space conditioning systems. The goal of this research program is to determine the feasibility of ground coupling, and if feasibility is confirmed, to create handbooks which facilitate widespread application of ground coupling. The research program is outlined and the research projects currently in progress and how they fit into the program are described. Progress toward the program goal is evaluated. DOE

N80-29868# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ENVIRONMENTAL CONSTRAINTS ON GEOTHERMAL ENERGY

R. B. Craig 1979 8 p refs Presented at the Intern Conf. on Energy Use Management, Los Angeles, 22 Oct. 1979

(Contract W-7405-eng-26)

(ORNL-1310; CONF-791009) Avail: NTIS HC A02/MF A01

The environmental impacts of DOE's major geothermal programs and more than 15 projects at specific sites have been assessed. Site characteristics conducive to potentially severe environmental impacts and which tend to recur at site after site were identified. These characteristics are discussed. DOE

N80-29869# Idaho National Engineering Lab., Idaho Falls.

HYDROTHERMAL ENERGY: A SOURCE OF ENERGY FOR ALCOHOL PRODUCTION

R. R. Stiger 1980 11 p Presented at the Alcohol Alternative Conf., Chicago, 1 May 1980

(Contracts EY-76-C-07-1570; DE-AC07-76ID-01570)

(CONF-800526-1) Avail: NTIS HC A02/MF A01

A small scale (1 gal/hr) biomass-to-alcohol still was built at the Raft River Geothermal Site to investigate difficulties in geothermal assisted biomass conversion. The unit was successfully operated, producing 95% (190 proof) ethanol from sugar beet juice. The unit was designed and built in less than eight weeks from surplus equipment using commercially available design information. This small scale still demonstrated that 95% ethanol can be produced from sugar beet beer containing 8 to 10% alcohol using geothermal energy and present commercial technology. The geothermal energy and present commercial technology. The geothermal resource provided both an energy source and process water. Recently, a study was completed to analyze the economic feasibility of producing ethanol from potatoes, wheats, and sugar beets using geothermal resources available in the Raft River Region of Idaho. The study concluded that a 20 million gallon per year facility can be built that will supply alcohol at $1.78 per gallon using geothermal energy. DOE

N80-29870# Solar Turbines International, San Diego, Calif.

DEVELOPMENT OF POLYIMIDE MATERIALS FOR USE IN SOLAR ENERGY SYSTEMS Final Report, 1 Aug. 1978 - 31 Jul. 1979

A. L. Wilcoxson, U. A. Sorathia, and J. Gagliani 1980 61 p refs

(Contracts EM-78-C-04-5305; DE-AS04-78CS-35305)

(DOE/CS-35305/T2) Avail: NTIS HC A04/MF A01

A program to optimize and characterize improved insulation materials for solar energy systems is described. Two separate and distinct products have been studied, a lightweight flexible insulating foam and a high density, rigid, load bearing insulating foam. These products are derived from a polyimide resin, the formulations and processes for which were developed under NASA-JSC sponsored programs. These materials are nonburning and do not emit measurable quantities of smoke or toxic by-products. Candidate resins were selected on the basis of cost, expected foam insulating and weatherability properties and ease of production. Critical characterization parameters were established for the flexible insulating foam in the form of environmental exposure resistance, thermal conductivity and hydrolytic stability. Studies initiated to improve the exposure resistance included additive studies, using reinforcements and UV absorbers, and postcure and densification studies. Optimum resin formulations, foam densities and foam structures were identified on the basis of the exposure, thermal conductivity, and microwave testing. DOE

N80-29871# American Science and Engineering, Inc., Cambridge, Mass.

DEVELOPMENT OF A SECOND GENERATION CONCENTRATING TRACKING SOLAR COLLECTOR Final Report, 19 Jun. - 31 Oct. 1979

31 Mar. 1980 10 p

(Contract EM-78-C-04-4275)

(ASE-4524) Avail: NTIS HC A02/MF A01

Results are presented of testing done on the Second Generation Concentrating Tracking Solar Collector. This includes testing of both the single tube collector shown in Figure 1 and the 4' x 8' collector shown in Figure 2. The testing was performed between April 1979 and February 1980 under various conditions. Air conditions included clear air, haze and smog, and ambient temperature varied widely. The diversity of testing conditions provided a realistic evaluation of collector performance. DOE

N80-29872# Midwest Research Inst., Golden, Colo. Solar Thermal Research Branch.

ANALYSIS OF THE OMNIUM G RECEIVER

Mark Bohn Mar. 1980 31 p refs

(Contract EG-77-C-01-4042)

(SERI/TR-631-387) Avail: NTIS HC A03/MF A01

A thermal analysis of the Omnium-G receiver is presented and the technique is shown to be generally applicable to solar thermal receivers utilizing a directly heated thermal mass. The thermal loss coefficient, including reradiation losses, is calculated and shown to agree quite well with the experimentally measured thermal loss coefficient. The rate of heat transfer to the working fluid is also analyzed and the analysis is used to show that the Omnium-G receiver is well matched to the water/steam working fluid because the steam outlet temperature is almost the same as the receiver temperature. A general procedure for calculating receiver performance is presented. With this procedure, the energy delivery to any working fluid, the delivered temperature of the working fluid, and the pressure drop through the receiver can be determined. An example of the calculation is also presented. DOE

N80-29873# University of Southern California, Los Angeles. Dept. of Materials Science.

LOW COST SOLAR CELLS BASED ON AMORPHOUS SILICON ELECTRODEPOSITED FROM ORGANIC SOLVENTS Technical Quarterly Progress Report, 1 Mar. - 31 May 1979

F. A. Kroger 1980 31 p

(Contract EY-76-S-03-0113)

(SAN-0113-040-T7; TQPR-3) Avail: NTIS HC A03/MF A01

Electrolysis experiments were carried out using tetra ethyl ortho silicate plus propylene carbonate or 1-chloropropane or acetic acid or formamide and ammonium hexafluorosilicate plus formamide. These experiments yielded deposits which vary in color between white and black with greyish white, light or dark brown as intermediate colors depending on the deposition conditions. Energy dispersive X-ray analysis in the scanning electron microscope indicated the deposits to contain large concentrations of silicon; infrared absorption and reflection studied showed bands characteristics of Si-O, Si-Cl or Si-F vibrations and this indicates the presence of these elements in the films. Determination of carrier type in doped deposits by hot point probe method was not successful. DOE

N80-29874# Midwest Research Inst., Golden, Colo. Photovoltaic Advanced Silicon Div.

MIS AND SIS SOLAR CELLS ON POLYCRYSTALLINE SILICON

Gary Cheek and Robert Mertens (Catholic Univ. of Leuven, Belgium) Feb. 1980 29 p refs

(Contract EG-77-C-01-4042)
(SERI/TR-311-493) Avail: NTIS HC A03/MF A01

MIS and SIS structured solar cells are receiving much attention in the photovoltaic community. Seemingly, these cells could be a viable alternative to thermally diffused p-n junctions for use on thin-film polycrystalline silicon substrates. This review describes MIS/SIS structured solar cells and the possible advantages of these structures for use with thin-film polycrystalline silicon. The results of efficiency calculations are presented. Also addressed are lifetime stability and fabrication techniques amenable to large scale production. Finally, the relative advantages and disadvantages of these cells and the results obtained are presented. DOE

N80-29875# California Univ., Livermore. Lawrence Livermore Lab.
REACTIVELY SPUTTERED THIN FILM Cu/sub x/S/CdS PHOTOVOLTAIC DEVICES Final Progress Report, 1 Oct. 1978 - 30 Sep. 1979
L. D. Partain, G. A. Armantrout, J. H. Yee, J. Y. Leong, and D. OKubo 2 Apr. 1980 162 p refs
(Contract W-7405-eng-48)
(UCID-18592) Avail: NTIS HC A08/MF A01

Properties not explained by standard theory are well modeled by space-charge-limited current analysis. Extension of the SEM electron beam induced current techniques coupled with the material fabrications obtained with sputtering allowed rather complete characterizations of thin film devices for the first time. These included the minority and majority carrier transport parameters and the optical properties and indicated that unanticipated parameters determine performance and control repeatability and should establish device stability limits. The junction region losses of minority carrier current are identified as a dominant effect of heat treatment and actual junction collection efficiency values are quantified. Sputtering allowed free standing, polycrystalline Cu/sub x/S films to be formed on glass for clear determinations of charge transport and optical properties in addition to providing a highly planar geometry on the CdS substrates required for the SEM studies. DOE

N80-29876# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
DESIGN OF A PHOTOVOLTAIC SYSTEM FOR A SOUTHWEST ALL-ELECTRIC RESIDENCE
E. M. Mehalick, G. Obrien, G. F. Tully, J. Johnson, and J. Parker Apr. 1980 220 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7056) Avail: NTIS HC A14/MF A01

The grid connected residential photovoltaic system for the Southwest is designed to meet both space conditioning requirements and all conventional electrical load requirements for an all-electric residence. The system is comprised of two major subsystems, the solar array and the power conditioning subsystem (PCS). An 8 kW peak photovoltaic array been designed for the house. The 93 square meters solar array uses a shingle solar cell module in a highly redundant series/parallel matrix. The photovoltaic generated power is supplied to a 10kVA power conversion subsystem which is controlled to track the solar array maximum power operating point and feed the 240 Vac output power directly to the house loads or back to the utility when excess power is generated. The photovoltaic power is isolated from the utility by a 15 kVA transformer. The house design and subsystem specifications are given in detail. DOE

N80-29877# Commission of the European Communities, Ispra (Italy). Joint Research Center.
STANDARD PROCEDURES FOR TERRESTRIAL PHOTOVOLTAIC PERFORMANCE MEASUREMENTS: SPECIFICATION NO. 101
1979 40 p
(EUR-6423EN) Avail: NTIS HC A03/MF A01

Since the response of a solar cell is wavelength-dependent, its performance is significantly affected by the spectral energy distribution of the radiation, which in the case of natural sunlight varies with location, weather, time of year, and time of day. If the irradiance is measured with a thermopile-type radiometer, which is not spectrally selective, rated power measurements can vary by as much as 15% from day to day at the same place. The procedures are designed to minimize such discrepancies by relating the performance to a standard terrestrial solar spectral energy distribution, hereafter referred to as standard sunlight. This is done by measuring irradiance with a reference solar cell or module which has been calibrated at 25 + or -2 C in terms of short circuit current per unit of standard sunlight irradiance by an approved Solar Cell Calibration Agency. The reference cell automatically takes account of variation in spectral distribution. If the performance of a cell, module or array is related to a known standard sunlight distribution, it is possible to compute within a reasonable tolerance its performance in light or any other known spectral energy distribution. DOE

N80-29878# European Space Research and Technology Center, Noordwijk (Netherlands).
EUROPEAN TECHNOLOGY APPLICABLE TO SOLAR POWER SATELLITE SYSTEMS (SPS)
H. Stoewer 1979 24 p refs Presented at the 30th Congr. of the Intern. Astronautical Federation, Munich, 16 Sep. 1979
(INKA-Conf-79-378-046; CONF-7909124-1; IAF-79-174) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The Solar Power Satellite System (SPS) stands for a concept which is intended to collect energy in Earth orbit, transmit it to the Earth and convert it on the ground into electric energy. This paper summarizes European space technology activities that might have potential for application in a possible future Solar Power Satellite System (SPS) program. Before a decision in favor of or against an SPS development program can be made, several critical technology areas must be investigated in order to assess with a reasonable degree of confidence the potential benefits, cost and development risks associated with an SPS. Existing and developing European space technologies are compared with the expected requirements of a study assessment and early key technology verification investigations for SPS concept. It is shown that a number of existing European space technologies and the results of current development efforts apply well to this. However, very substantial advances in almost all technological areas will be necessary before a prudent decision for implementation of an SPS can be made. DOE

N80-29879# Motorola, Inc., Phoenix, Ariz. Solar Energy Dept.
THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Final Report, 25 Sep. 1978 - 25 Sep. 1979
K. R. Sarma, M. J. Rice, R. Legge, R. W. Gurtler, and W. C. Ramsey 1 Dec. 1979 93 p refs
(Contract ET-78-C-03-2207)
(SAN-2207-T4) Avail: NTIS HC A05/MF A01

Methods of depositing thin polycrystalline silicon films, utilizing an energy beam, for producing solar cells capable of meeting long range economic and performance objectives are discussed. Progress is reported in detail on the (1) investigation of the energy beam as a means for efficient, high-rate deposition of polysilicon films; (2) development of temporary, reusable substrates for polysilicon deposition; (3) subsequent grain enhancement of self-supporting thin silicon films through laser recrystallization; and (4) demonstration of at least 10 percent efficient solar cells fabricated on these grain enhanced silicon films. DOE

N80-29880# General Accounting Office, Washington, D. C.
THE 20 PERCENT SOLAR ENERGY GOAL: IS THERE A PLAN TO ATTAIN IT?
E. B. Staats 31 Mar. 1980 15 p refs
(EMD-80-64) Avail: General Accounting Office, Washington, D.C.

The Administration's efforts, primarily those of the Department of Energy, to attain the goal of meeting 20% of the Nation's energy needs from solar resources by the year 2000 are reviewed. It was observed that while the President called for several legislative initiatives and the creation of a Solar Subcommittee, actions on them are underway, but none have yet been finalized. DOE

N80-29881# Brookhaven National Lab., Upton, N. Y.
PHOTOVOLTAIC/THERMAL HYBRID PROJECTS
Edward A. Kush 1980 5 p refs Presented at the Ann. DOE Active Solar Heating and Cooling Contractors' Rev. Meeting, Incline, Nev., 26-28 Mar. 1980
(Contracts EY-76-C-02-0016; DE-AC02-78CH-00016)
(BNL-27669) Avail: NTIS HC A02/MF A01

Systems which utilize a combination of photovoltaic and thermal collection in the same solar collectors (PV/T Systems) can have advantages over PV or thermal only systems in that the cost effectiveness of the collectors and their support structure may be improved, active cooling may allow the cells to run at lower temperatures-hence higher conversion efficiency, and space limitations on side by side collectors can be avoided. Evaluation of such systems requires formulation and assessment of collector concepts, power conditioning, storage, and control strategies, and their interactions when combined into a total system. Systems with flat plate PV/T collectors and vapor compression heat pump driven by the photovoltaic electric output are considered along with PV/T concentrating collectors and their potential applications, particularly to solar driven absorption chillers. DOE

N80-29882# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
USER EVALUATION STUDY OF PASSIVE SOLAR RESIDENCES
Sharyn Towle Mar. 1980 6 p Presented at the 4th Natl. Passive Solar Energy Conf., Kansas City, Kan., 3-5 Oct. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-63-350; CONF-791022-16) Avail: NTIS HC A02/MF A01

The readiness of various passive solar energy techniques for commercialization and market potential for residential applications is assessed. The preliminary findings of a market assessment study designed to document user experiences with passive solar energy are discussed. Owners and builders of passive solar homes were interviewed and asked to comment on personal experiences with their homes. DOE

N80-29883# Suntek Research Associates, Corte Madera, Calif.
ENGINEERING DESIGN FOR THERMOCRETE CENTRAL STORAGE UNITS FOR LOW TEMPERATURE SOLAR APPLICATION Final Report
1979 11 p refs
(Contract DE-AC02-78CS-34702)
(DOE/CS-34702/4) Avail: NTIS HC A02/MF A01

The overall objective was to produce a set of value-engineered blueprints for mass-produced modular phase-change thermal storage units. As a result of the failure of Thermocrete samples during thermal evaluation, DOE project management and Suntek agreed that work on Thermocrete should be stopped at the end of September 1978, and that work should commence on incorporating Heat Mirror transparent insulation into windows and skylights. Since work on Thermocrete was stopped at approximately 20 percent complete, no blueprints were produced nor were any firm conclusions reached. The technical report outlines briefly the status of each section of work statement when the project was stopped. DOE

N80-29884# Oak Ridge National Lab., Tenn. Solar and Special Studies Station.
PASSIVE SOLAR HEATING AND NATURAL COOLING OF AN EARTH-INTEGRATED DESIGN
Paul R. Barnes and Hanna B. Shapira 1980 7 p refs Presented at the Natl. Tech. Conf. on Earth Sheltered Building Design Innovations, Oklahoma City, 18 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800449-1) Avail: NTIS HC A02/MF A01

The Joint Institute for Heavy Ion Research is being designed with innovative features that will greatly reduce its energy consumption for heating, cooling, and lighting. A reference design has been studied and the effects of extending the overhang during summer and fall, varying glazing area, employing RIB, and reducing internal heat by natural lighting have been considered. The use of RIB and the extendable overhang increases the optimum window glazing area and the solar heating fraction. A mass-storage wall which will likely be included in the final design has also been considered. A figure of merit for commercial buildings is the total annual energy consumption per unit area of floor space. A highly efficient office building in the Oak Ridge area typically uses 120 to 160 kW hr/m sq. The Joint Institute reference design with natural lighting, an annual average heat pump coefficient of performance (COP) equal to 1.8, RIB, and the extendable overhang uses 71 kWhr/m sq. This figure was determined from NBSLD simulation corrected for the saving from RIB. DOE

N80-29885# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELL APPLIED RESEARCH: ELECTROCATALYSIS AND MATERIALS Quarterly Report, 1 Oct. - 31 Dec. 1978
S. Srinivasan, H. S. Isaacs, J. McBreen, W. E. Ogrady, H. Olender, L. J. Olmer, E. J. Taylor, C. Y. Yang, and G. P. Wirtz Jul. 1979 36 p refs
(Contract EY-76-C-02-0016)
(BNL-51072) Avail: NTIS HC A03/MF A01

Investigations were carried out on the sintering of carbon supported platinum catalysts in phosphoric acid at 150 C over a 3500 hour period. The most significant result was that the sintering rate was five times slower for these electrodes as compared with unsupported platinum electrodes. After aging the electrodes for 1200 h, attempts were made to regenerate the active areas of one of the electrodes by cycling at 100 V/s in various voltage envelopes between -0.1 V and 1.1 V. These treatments were unsuccessful for regeneration of the activity. A ring-disc electrode investigation of oxygen reduction in 85 percent phosphoric acid was carried out. Work included determination of the Tafel parameters, oxygen diffusivity, reaction order, and the extent of peroxide formation. Also, solid electrolyte fuel cells were studied. A cell was designed and fabricated for measurement of oxygen diffusion in interconnection materials. Both transient and steady methods are being used and diffusivity as well as concentration of diffusing species can be obtained. The cell is being calibrated by measuring oxygen diffusion in nickel foils of various thickness. Oxygen ion transport in In_2O_3, an oxygen electrode material, was also investigated using the oxide as a membrane, but leakage at the edges of cells prevented direct measurements. DOE

N80-29886*# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluations Group.
PRELIMINARY COMPARATIVE ASSESSMENT OF LAND USE FOR THE SATELLITE POWER SYSTEM (SPS) AND ALTERNATIVE ELECTRIC ENERGY TECHNOLOGIES
D. E. Newsom and T. D. Wolsko Apr. 1980 26 p refs Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-163327; DOE/ER-0054) Avail: NTIS HC A03/MF A01 CSCL 10A

A preliminary comparative assessment of land use for the satellite power system (SPS), other solar technologies, and alternative electric energy technologies was conducted. The alternative technologies are coal gasification/combined-cycle, coal fluidized-bed combustion (FBC), light water reactor (LWR), liquid metal fast breeder reactor (LMFBR), terrestrial photovoltaics (TPV), solar thermal electric (STE), and ocean thermal energy conversion (OTEC). The major issues of a land use assessment are the quantity, purpose, duration, location, and costs of the required land use. The phased methodology described treats the first four issues, but not the costs. Several past efforts are comparative or single technology assessment are reviewed briefly. The current state of knowledge about land use is described for each technology. Conclusions are drawn regarding deficiencies in the data on comparative land use and needs for further research. DOE

N80-29887*# Argonne National Lab., Ill. Integrated Assessment and Policy Evaluation Group.
SELECTION OF ALTERNATIVE CENTRAL-STATION TECHNOLOGIES FOR THE SATELLITE POWER SYSTEM (SPS) COMPARATIVE ASSESSMENT
Michael E. Samsa Apr. 1980 19 p Sponsored by NASA
(Contract W-31-109-eng-38)
(NASA-CR-163328; DOE/ER-0052) Avail: NTIS HC A02/MF A01 CSCL 10A

An important effort is the Satellite Power System (SPS) comparative Assessment is the selection and characterization of alternative technologies to be compared with the SPS concept.

The ground rules, criteria, and screening procedure applied in the selection of those alternative technologies are summarized. The final set of central station alternatives selected for comparison with the SPS concept includes: (1) light water reactor with improved fuel utilization, (2) conventional coal combustion with improved environmental controls, (3) open cycle gas turbine with integral low Btu gasifier, (4) terrestrial photovoltaic, (5) liquid metal fast breeder reactor, and (6) magnetic confinement fusion. DOE

N80-29888# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

ELECTRIC UTILITIES AND RESIDENTIAL SOLAR SYSTEMS

Robert Bright and Harry Dawitian Apr. 1980 17 p ref Proposed for presentation at the 1980 Ann. Meeting of the Am. Sect., Intern. Solar Energy Soc. Conf., 2 Jun. 1980 Submitted for publication

(Contracts EY-76-C-02-0016)

(BNL-27711; CONF-800604-21) Avail: NTIS HC A02/MF A01

The long-run incremental cost (LRIC) of providing electricity for solar heating and hot water systems is estimated for three utilities using a utility capacity expansion model and compared to the cost of providing electricity to electric-only systems. It is found that the LRIC for solar backup is no more than the LRIC of electricity used for purely electric heating and hot water devices and also no more than the incremental cost of normal load growth. For the three utilities, there appears to be little basis for rate distinctions between solar devices using electric backup and electric only heating and hot water devices. Off-peak storage heating and hot water devices have a much lower LRIC than the standard systems. Compared to average cost pricing, incremental cost pricing offers considerable benefits to customers using solar and electric heat and hot water, especially if a separate lower rate is adopted for off-peak storage devices. Substantial savings in the use of oil and gas fuels can be achieved if residences using these fuels convert to solar systems, savings not necessarily achievable by a shift, instead, to electric systems. DOE

N80-29889# Sandia Labs., Albuquerque, N. Mex.

SURVEY OF SELECTIVE SOLAR ABSORBERS AND THEIR LIMITATIONS

D. M. Mattox 1980 25 p refs Presented at the Intern. Conf. on Mater. for Photothermal Energy Conversion, Corsica, France, 6 May 1980

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-2371C; CONF-800530-1) Avail: NTIS HC A02/MF A01

A number of selective absorber coating systems with high solar absorptance exist which may be used in the mid-temperature range. Some of the systems are more chemically and thermally stable than others. Unfortunately, there are large gaps in the stability data for a large number of the systems. In an inert environment, the principal degradation mechanisms are interdiffusion between the layers or phases and changes in surface morphology. These degradation mechanisms would be minimized by using refractory metals and compounds for the absorbing layer and using refractory materials or diffusion barriers for the underlayer. For use in a reactive environment, the choice of materials is much more restrictive since internal chemical reactions can change phase compositions and interfacial reactions can lead to loss of adhesion. For a coating process to be useful, it is necessary to determine what parameters influence the performance of the coating and the limits to these parameters. This process sensitivity has a direct influence on the production process controls necessary to produce a good product. Experience with electroplated black chrome has been rather disappointing. Electroplating should be a low cost deposition process but the extensive bath analysis and optical monitoring necessary to produce a thermally stable produce for use to 320 C has increased cost signficantly. DOE

N80-29890# Sandia Labs., Albuquerque, N. Mex.

DESIGN AND PERFORMANCE OF AN 11 kW SOLAR ARRAY SIMULATOR

D. R. Smith, George A. OSullivan, and Frances K. OSullivan 1980 6 p refs Presented at the Power Electron. Spec. Conf., Atlanta, 17 Jun. 1980 Prepared in cooperation with Abacus Controls, Inc., Somerville, N. J.

(Contract EY-76-C-04-0789)

(SAND-80-0873C; CONF-800624-2) Avail: NTIS HC A02/MF A01

A solar array simulator combines a high efficiency switching regulator, a high performance series regulator, and a low power analog adjustable I-V generator to duplicate the static and dynamic characteristics of photovoltaic cells operated in series parallel combinations. Both voltage and current feedback are used to control the switching and series regulators. Stability of the series regulator over a wide range of load time constants is achieved by a compensation technique. Current voltage and transient response characteristics of the simulator are presented. The device was also operated into a 10 kW inverter designed for photovoltaic applications. DOE

N80-29891# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

SCREENING METHOD FOR WIND ENERGY CONVERSION SYSTEMS

Robert D. McConnell Mar. 1980 6 p refs Presented at Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980

(Contract EG-77-C-01-4042)

(SERI/TP-731-649; CONF-800604-19) Avail: NTIS HC A02/MF A01

A screening method is presented for evaluating wind energy conversion systems (WECS) logically and consistently. It is a set of procedures supported by a data base for large conventional WECS. The procedures are flexible enough to accommodate concepts lacking cost and engineering detail, as is the case with many innovative wind energy conversion systems (IWECS) The method uses both value indicators and simplified cost estimating procedures. Value indicators are selected ratios of engineering parameters involving energy, mass, area, and power. Cost mass ratios and cost estimating relationships were determined from the conventional WECS data base to estimate or verify installation cost estimates for IWECS. These value indicators and cost estimating procedures are shown for conventional WECS. An application of the method to a tracked vehicle airfoil concept is presented. DOE

N80-29892# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

NATIONAL SOLAR OPTICAL MATERIALS PROGRAM PLAN: AN OVERVIEW

Keith D. Masterson Mar. 1980 6 p refs Presented at Los Angeles Tech. Symp., North Hollywood, Calif., 4-7 Feb. 1980; sponsored by Soc. of Photo-Opt. Instrumentation Engr.

(Contract EG-77-C-01-4042)

(SERI/TP-641-619; CONF-800207-3) Avail: NTIS HC A02/MF A01

A coordinated national program is being formulated to adapt and develop optical materials to support a goal of meeting 20% of our national energy needs with solar by the year 2000. The program contains elements covering absorber, reflector, and transmitter materials but no photovoltaic materials. These elements include research on glass and polymer materials for glazing and reflector components, environmental testing, and long-term reliability modeling. Program subelements that support R and D and encourage commercialization of new products are also discussed. An overview of the proposed funding levels is presented. DOE

N80-29893# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

BIOLOGICAL SOLAR CELL

Michael Seibert and A. Frederick Janzen (Photochemical Research Associates, Inc., London, Ontario) Apr. 1980 8 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980

(Contract EG-77-C-01-4042)

(SERI/TP-623-656; CONF-800604-16) Avail: NTIS HC A02/MF A01

Recent reports have demonstrated the possibility of employing photoactive, biological membrane components in photoelectrochemical cells. Present studies have led to the attachment of a

much simpler biological complex, the bacterial photosynthetic reaction center isolated from Rhodopseudomonas sphaeroides, directly onto a SnO2 semiconductor electrode. Light induced photovoltages and photocurrents not attributable to Dember effects were observed in photoelectrochemical cells employing reaction center coated, SnO2 working electrodes. Such reaction center electrodes may serve as model systems for future organic photovoltaic devices. DOE

N80-29894# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SUMMARY OF SOLAR EXPERIENCE WITH THE SOILING OF OPTICAL SURFACES
Patrick J. Call Feb. 1980 15 p refs Workshop held in Denver, 16-17 Jul. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-334-478) Avail: NTIS HC A02/MF A01

The results of a workshop held on July 16-17, 1979 to discuss available experimental data, current and planned experimental investigations, directly applicable optical principles, and relevant theory are summarized. The summary is in terms of the magnitude of effects on various types of systems and the effects of location, surface properties, and natural/artificial removal. The economics of prevention, tolerance, and removal are also summarized. DOE

N80-29895# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OVERVIEW OF THICK-FILM TECHNOLOGY AS APPLIED TO SOLAR CELLS
K. Firor and S. Hogan Jan. 1980 8 p refs Presented at the Electron. Component Conf. of the IEEE, 28-30 Apr. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-331-541; CONF-800421-3) Avail: NTIS HC A02/MF A01

The use of thick film technology in solar cell development is discussed in some detail. Screen printing as an alternate to more expensive, high vacuum techniques in several of the production steps during the manufacture of silicon solar cells is discussed. Screen printing is fairly well established as a means of providing electrical contact to a cell and for the formation of a back surface field. Under investigation are the possibilities of non-noble metal contacts and protective and antireflective coatings applied to solar cells by the use of screen printing. The fabrication of the active layers of a solar cell, using thick film inks made up of 2 to 6 semiconductors is also addressed. DOE

N80-29896# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
CHEMICAL VAPOR DEPOSITION OF THIN-FILM POLYCRYSTALLINE Si FOR LOW-COST SOLAR CELLS Quarterly Technical Progress Report, 23 Jul. - 2 Nov. 1979
Ralph P. Ruth, William I. Simpson, Levada A. Moudy, and Jane J. J. Yang Nov. 1979 35 p refs
(Contract DE-AC03-79ET-23045)
(DOE/ET-23045/1; QTPR-1) Avail: NTIS HC A03/MF A01

A research program conducted for the purpose of developing thin-film polycrystalline Si solar cells on low cost substrate materials, using chemical vapor deposition (CVD) techniques to prepare the films and vapor growth doping, thermal diffusion, or ion implantation to produce the required p-n junctions is discussed. An existing Si CVD reactor system is used for the investigations and its design features are discussed. System background doping concentrations and Si film growth rate uniformity were determined, and general film quality typical of the system and the reactants in use was established, including the properties of Si-on-saphire films prepared during the course of the initial investigations. These results are described in detail. A working curve for growth of boron-doped p type Si films was established for film growth at about 1000 C, covering the concentration range 1 x 10 to the 16th power to 3 x 10 to the 19th power per cu cm. DOE

N80-29897*# PRC Energy Analysis Co., McLean, Va.
SOME QUESTIONS AND ANSWERS ABOUT THE SATELLITE POWER SYSTEM (SPS)
Jan. 1980 46 p refs Sponsored by NASA
(Contract DE-AC01-79ER-10041)
(NASA-CR-163329; DOE/ER-0049/1) Avail: NTIS HC A03/MF A01 CSCL 10A

Progress in the evaluation of the concept of obtaining significant amount of electrical energy from space through the Satellite Power System is reported. The Concept Development and Evaluation Program plan is described including: systems definition, environmental assessment, societal assessment, and comparative assessment. DOE

N80-29898# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICATION Final Technical Report, 15 Mar. 1979 - 29 Feb. 1980
A. D. Jonath, W. W. Anderson, J. L. Crowley, H. F. MacMillan, F. A. Junga, J. F. Knudsen, K. M. Monahan, and J. A. Thornton Mar. 1980 69 p refs
(Contract DE-AC03-79ET-23040)
(DOE/ET-23040/4; LMSC-D766003) Avail: NTIS HC A04/MF A01

Magnetron sputtering, a deposition method in which magnetic confinement of a plasma encourages high deposition rates at low working gas partial pressures, is under investigation as a candidate production technology for large scale manufacture of high efficiency, thin film amorphous silicon solar photovoltaic cells. The approach uses two dc magnetron geometries: (1) a low-cost planar magnetron (PM) system for exploratory and detailed examination of deposition parameter space; and (2) a cylindrical magnetron (CM) system, scalable to production sizes, for deposition of homogeneous films over large areas. Detailed descriptions of these two systems are included. Amorphous silicon films and device structures were sputtered in both PM and CM systems under a wide range of deposition conditions using both doped and undoped sputter targets. Measured electrical and optical film properties indicate that control over a wide range of conductivity, photoconductivity, conductivity activation energy, and optical and infrared absorption behavior is achievable. DOE

N80-29899# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Sep. - 19 Dec. 1979
Mark Ueland 28 Dec. 1979 11 p refs
(Grant EG-77-G-04-4135)
(ALO-4135-T2; TPR-9) Avail: NTIS HC A02/MF A01

A program of applied research was developed for the design, construction, and monitoring of an inovative concept of solar heating and cooling called solar atrium. The solar atrium concept is adaptable to residences and smaller commercial and institutional buildings. It is designed to be constructed of materials and equipment that are economical and readily available. Cost effectiveness of installation and operation is a primary design objective. Progress in construction and instrumentation is listed. DOE

N80-29900*# Department of Energy, Washington, D. C. Office of Energy Research.
SATELLITE POWER SYSTEM (SPS) FY 79 PROGRAM SUMMARY
Jan. 1980 200 p refs
(NASA-CR-163479; DOE/ER-0037) Avail: NTIS HC A09/MF A01 CSCL 10A

The Satellite Power System (SPS) program a joint effort to develop an initial understanding of the technical feasibility, the economic practicality, and the social and environmental acceptability of the SPS concept is discussed. This is being accomplished through implementation of the Concept Development and Evaluation Program Plan which is scheduled for completion by the end of FY 1980. This Program Summary not only covers FY 1979 but includes work completed in FY 1977 and FY 1978 in order to give a comprehensive picture of the DOE involvement in the SPS concept development and evaluation process. DOE

N80-29901# General Electric Co., Philadelphia, Pa. Space Div.
DYNAMIC ISOTOPE POWER SYSTEM (DIPS) APPLICATIONS STUDY. VOLUME 1: SUMMARY Final Report
Nov. 1979 64 p 3 Vol.

(Contract ET-78-C-01-3267)
(DOE/ET-3267/1-Vol-1; GESD-79DS4228-Vol-1) Avail: NTIS HC A04/MF A01

The Nuclear Integrated Multimission Spacecraft is designed for communications, surveillance, navigation, and meteorological missions. This study assesses the attributes of the Dynamic Isotope Power System for this spacecraft. These attributes include cost, system, mission compatibility, and survivability. DOE

N80-29902# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
SOLAR POND STUDIES, PHASE 3 M.S. Thesis. Semiannual Progress Report
Howard C. Bryant and Markus Karl Rothmeyer 10 Jan. 1980 126 p refs
(Contract EY-77-S-04-3977)
(ALO-3977-5; SAPR-5) Avail: NTIS HC A06/MF A01

The diffusion equation for salt gradient solar ponds was modified to include the Soret effect. The contribution of the Soret effect to the diffusion flux of salt is shown to be on the order of 4% in the winter and 28% in the summer for the UNM NaCl solar pond. The traditional stability criterion for solar ponds remains practically unchanged by the Soret effect. However, the contribution of nonconstant properties seems to be significant. Saturated solar ponds are described by a system of differential equations which include the Soret effect, the formation, and redissolving of crystals. The analytical solutions of this system are given for the steady-state and constant properties. A laboratory experiment using KNO3 confirms the existence of a stable saturated gradient. Temperatures of up to 90 C and temperature gradients of up to 2 C/cm were used in the experiment without any sign of convective layers. DOE

N80-29903# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
HUMAN COMFORT AND AUXILIARY CONTROL CONSIDERATIONS IN PASSIVE SOLAR STRUCTURES
Wayne Place, Ronald Kammerud, Brandt Andersson, Benay Curtis, William Carroll, Craig Christensen, and Mark Hannifan Apr. 1980 9 p refs Presented at the Intern. Congr. on Building Energy Management, Povoa de Varzim, Portugal, 12-16 May 1980 Prepared in cooperation with Midwest Research Inst., Golden, Colo.
(Contract W-7405-eng-48)
(LBL-10034; CONF-800524-3) Avail: NTIS HC A02/MF A01

Energy consumption and human comfort implications of various passive solar and energy conservation strategies are investigated for single family, one story, slab on grade residences in Albuquerque, NM and Washington, DC. The building energy analysis computer program BLAST is used to perform annual dynamic heating and cooling load calculations for a building in which the glazing area, glazing location, and thermal mass are varied systematically. The impacts on building performance of forced flow ventilative cooling and nighttime and weekday thermostat setpoint adjustments are investigated. The results indicate that the annual heating and cooling loads are highly sensitive to glazing area, glazing location, and thermostatic controls. Annual cooling loads are substantially reduced by increased thermal mass in the walls. In contrast, annual heating loads are fairly insensitive to increased thermal mass in the walls, unless very large areas of south glazing are involved. DOE

N80-29904# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
OVERVIEW-ABSORPTION/RANKINE SOLAR COOLING PROGRAM
Michael Wahlig, Al Heitz, and Barbara Boyce Mar. 1980 5 p Presented at the Ann. DOE Active Solar Heating and Cooling Contractors' Rev. Meeting, Incline Village, Nev., 26-28 Mar. 1980
(Contract W-7405-eng-48)
(LBL-10770; CONF-800340-7) Avail: NTIS HC A02/MF A01

The tasks being performed in the absorption and Rankine program areas run the gamut from basic work on fluids to development of chillers and chiller components, to field and reliability testing of complete cooling systems. In the absorption program, there are six current and five essentially completed projects. In the Rankine program, there are five current projects directly supported by DOE, and three projects funded through and managed by NASA/MSFC (Manned Space Flight Center, Huntsville, Alabama). The basic features of these projects are discussed. The systems under development in five of these current projects were selected for field testing in the SOLERAS program, a joint US-Saudi Arabian enterprise. Some technical highlights of the program are presented. DOE

N80-29905# Brown, Boveri und Cie. A.G., Heidelberg (West Germany). Zentrales Forschungslab.
DEVELOPMENT OF SODIUM SULFUR BATTERIES Final Report
Roland Bauer, Wilfried Fischer, Wilhelm Haar, Bernd Hartmann, Herbert Kleinschmager, Hennar Meinhold, and Gert Weddigen Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 126 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-60; ISSN-0340-7608) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26,05

The principal problems in the development of sodium sulfur batteries are essentially solved now that a 10 kWhr experimental battery was tested successfully. Extrapolation of the experimental results permits the conclusion that the properties necessary for application can be defined. The beta-alumina solid electrolyte was optimized with respect to electrical conductivity and lifetime. The sulfur electrode was improved with respect to sulfur utilization and the cathode current collector case with respect to corrosion resistance. Cells of the type being used in an experimental battery (60 to 90 Whr/kg depending on charge/discharge time) were cycled up to 350 times. Capacity declined 3 to 30% during this time, the rate being dependent on casing material. The energy density of cells optimized with respect to weight amounts to about 165 Whr/kg. The first results achieved with the 10 kWh experimental battery are in accordance with results obtained with single cells. Higher energy density, higher lifetime, and better thermal insulation must be achieved. Author (ESA)

N80-29906# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT, SOLAR ABSORBER SURFACES Final Report
Werner Scherber and Guenther Dietrich Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 113 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-70; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 23,55

Preparation techniques for selective coatings on high temperature solar collectors and their economic use were investigated by reproducing and improving known methods as well as developing alternative types of selective coatings. All samples were evaluated applying uniform criteria. The transfer of laboratory results to large area deposition is demonstrated to be feasible for a coating suitable for absorber temperatures up to 400 C. In-service results for prototypes of selective coated central receiver tubes produced and installed in a 10 kW solar power station in Cairo, Egypt are discussed. Author (ESA)

N80-29907# Battelle Inst., Frankfurt am Main (West Germany).
DEVELOPMENT OF A CADMIUM SELENIDE THIN FILM SOLAR CELL Final Report
Dieter Bonnet Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-72; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18,50

A project aimed at developing a CdSe MIS thin film solar cell was conducted. Fourteen materials were studied with regard to their suitability as I-layers. Two of these compounds, i.e., ZnSe and SbSe, were found to result in cells with relatively high photovoltage and high photocurrent. The preparation procedure for 2 micron thick active CdSe film was optimized

with respect to all essential parameters. Commercial, nominally very pure CdSe material from six manufacturers was found either to be unsuited or to lead to properties greatly varying from batch to batch. The best reproducible results were obtained with a material directly synthesized from elements which are commercially available in highly pure form. Tests show that experimental cells achieve efficiencies of 4.5%. Short circuit densities of more than 25 mA/cu cm, given incident solar radiation of 100 mW/cu cm, and open circuit voltages around 600 mV are realized. Further enhancement of the photovoltage up to 700 or 800 mV seems possibly by suitable doping of the CdSe layer and compensation of the doping near the surface. This as well as an enhancement of the fill factor from 55% to 70% could increase the cell efficiency to 9 or 10%. Author (ESA)

N80-29908# Deutsche Automobilgesellschaft m.b.H., Esslingen (West Germany). Forschungslab.

NICKEL HYDROGEN CELL DEVELOPMENT CENTERED ON POSITIVE ELECTRODES WITH HIGH CAPACITY PER UNIT AREA FOR LOAD LEVELING AND TRACTION APPLICATIONS Final Report

Guenter Gutmann and Rolf Linkohr Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 108 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-74) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.70

Scale-up of single cell storage batteries to adapt the system to electric vehicle and load leveling applications was pursued. The development of a low cost Ni/H2 cell making use of positive electrodes of high capacity per unit area (70 to 120 mAhr/cu cm), for orbiting satellites and super to sealed Ni/Cd cells in energy density and reliability is considered. Results from a heat management study reveal that under traction conditions, cell size must be restriced to 120 Ahr. Feasibility of cells with nonhydrophobic negatives together with positives of 100 to 120 mAhr/cu cm was shown experimentally, best performance data being obtained with 2.2 to 2.6 cu cm/Ahr of electrolyte for a one to two hour discharge rate. Results for two 130 Ahr cells show the limits of thermal capability as built; without additional cooling only 87 percent of the capacity of positives inserted can be taken from the cells. An energy density of 47 Whr/kg is demonstrated at the two to five hour discharge rate. Self discharge is found to be about 8 percent per day. According to materials savings and the reduction in number of stack parts achieved by the cell design, costs are cut to about half that of designs now in use. Author (ESA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-29909 Maryland Univ., College Park.

COMPOSITION OF PARTICULATE TRACE ELEMENTS IN PLUMES FROM INDUSTRIAL SOURCES Ph.D. Thesis

Mark Small 1979 463 p

Avail: Univ. Microfilms Order No. 8016999

Relative abundances of many elements attached to particles were determined for emissions from three types of industrial sources: copper smelters, a lime kiln and an integrated iron and steel works. Plume samples were collected with an instrumented light aircraft and analyzed by instrumental neutron activation analysis and atomic absorption for up to forty elements. Chemical-element balances were used to estimate contributions from each of these sources to the total suspended particulate material of several urban centers. Air filter samples from plumes of five copper smelters in southeastern Arizona were analyzed for 37 elements. Abundances of many volatile and chalcophilic elements were found to be greatly enriched compared to the crustal abundance pattern for those elements. Crustal enrichment factors, relative to Al, of up to 75 million were observed. Among the five smelters studied, concentrations relative to copper for many elements varied by as much as two orders of magnitude. These unique relative abundance patterns permitted the determination of particulate material from specific smelters in ambient air. Dissert. Abstr.

N80-29910 Stanford Univ., Calif.

MODELING AND ANALYSIS OF AIR QUALITY DATA Ph.D. Thesis

Cyril Daniel Grivet 1980 176 p

Avail: Univ. Microfilms Order No. 8016824

Air pollution was monitored in the San Francisco Bay Area at some 30 stations. The data collected was intended to be representative of air pollution in the whole air basin. It was also assumed that the manner in which these data were summarized and reported was appropriate for comparisons with air quality standards. The variations in pollution levels with time and location were assessed in order to gauge the representativity of air pollution data collected. Meteorology was an obvious factor of these variations so that the statistical interplay between pollution and weather was first investigated. This investigation was limited to oxidant, the worst pollutant in the Bay Area, and to the months of July and August, the worst months for oxidant pollution. It was actually the logarithm of the oxidant level which was used, for statistical reasons. There were eight weather variables available to summarize the meteorology of the Bay Area: temperature, wind, speed, percentage sunshine and stability at various locations. The linear effect of the weather on pollution was gauged through regressions. Dissert. Abstr.

N80-29911*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECTS OF CONVERSATION INTERFERENCE ON ANNOYANCE DUE TO AIRCRAFT NOISE

Kelli F. Key and Clemans A. Powell Aug. 1980 38 p refs

(NASA-TP-1712; L-13709) Avail: NTIS HC A03/MF A01 CSCL 13B

The annoyance and interference effects of aircraft flyover noise on face to face conversation were investigated. Twenty 5 minute sessions, each composed of three flyovers, were presented to each of 20 pairs of female subjects in a simulated living room. Flyovers varied in peak noise level (55-79 dB, A-weighted) and spectrum (low or high frequency components). Subjects engaged in conversation for 10 sessions and in reverie for the other 10 sessions, and completed subjective ratings following every session. Annoyance was affected by noise level, but was not significantly different for the two activities of reverie and conversation. A noise level of 77 db was found unacceptable for conversation by 50 percent of the subjects. Conversation interference was assessed by incidence of increased vocal effort and/or interruption of conversation during flyovers. Although conversation interference increased with noise level, the conversation interference measures did not improve prediction of individual annoyance judgments. Author

N80-29912# Department of Energy, Washington, D. C. Office of Technology Impacts.

ENVIRONMENTAL DATA, ENERGY TECHNOLOGY CHARACTERIZATIONS: GEOTHERMAL

Apr. 1980 41 p refs

(DOE/EV-0077) Avail: NTIS HC A03/MF A01

Two hydrothermal convective systems are discussed: vapor dominated and liquid dominated. The following topics are covered for each: characteristics, constraints, resource consumption, environmental considerations, and economic data. DOE

N80-29913# Environmental Protection Agency, Kansas City, Mo.

ENVIRONMENTAL EVALUATION OF GASOHOL PRODUCTION AND HEALTH EFFECTS

J. W. Mandia Oct. 1979 58 p Presented at the Environmental Evaluation Gasohol Production and Health Effects Seminar, Kansas City, Mo., 27 Jun. 1979 Prepared in cooperation with EPA, Cincinnati, Ohio

(EPA-907/9-79-005; CONF-7906160) Avail: NTIS HC A04/MF A01

Fermentation methods in the production of ethanol from cellulosic biomass are described. The environmental impacts of these processes are discussed. Problems in the disposal of residues of fermentation processes are also discussed. Emissions from the combustion of gasohol are tabulated. Advantages in the use

of gasohol vs gasoline are presented. Farm production of ethanol from agricultural residues is also discussed. DOE

N80-29914*# New Mexico Univ., Albuquerque. Technology Application Center.
ACID RAIN. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Apr. 1980
Mary K. Callagher May 1980 19 p Sponsored in part by NASA and NTIS
(NASA-CR-163324; PB80-810773) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

A bibliography containing 67 citations from international literature describing acid precipitation and its effects on the environment is presented. Topics covered include: air pollution, pollution monitoring, atmospheric composition, meteorological parameters and ecosystems. GRA

N80-29915# Gulf Research and Development Co., Chestwick, Pa.
EFFECT OF AMBIENT TEMPERATURE ON VEHICLE EMISSIONS AND PERFORMANCE FACTORS. APPENDIX C: GAS CHROMATOGRAPHIC RESULTS Final Report
R. S. Spindt, R. E. Dizak, R. M. Stewart, and A. P. Meyer Sep. 1979 837 p 2 Vol.
(Contract EPA-68-03-2530)
(PB80-173784; EPA-460/3-79-006C-App-C) Avail: NTIS HC A99/MF A01 CSCL 13B

Results of exhaust emissions (regulated and unregulated) and fuel economies associated with fourteen selected vehicles tested at ambient temperatures ranging from 0 F (18 C) to 110 F (43 C) using the various test procedures are presented. Separate analyses were made for each of the three phases of the Federal Test Procedure. The major components by group as well as the results on 75 individual peaks typically found are summarized. While many of the peaks represent individual compounds, others represent two or more compounds that were not separated. The total parts per million carbons (ppmc) by flame ionization detector is reported along with the total ppmc obtained by summing the gas chromatographic results. GRA

N80-29916# Gulf Research and Development Co., Chestwick, Pa.
EFFECT OF AMBIENT TEMPERATURE ON VEHICLE EMISSIONS AND PERFORMANCE FACTORS. APPENDIX A: TEST RESULTS FOR ALL VEHICLES. APPENDIX B: PLOTS OF EXHAUST GAS CATALYST OUT TEMPERATURES Final Report
R. S. Spindt, R. E. Dizak, R. M. Stewart, and W. A. P. Meyer Sep. 1979 501 p refs 2 Vol.
(Contract EPA-68-03-2530)
(PB80-173776; EPA-460/3-79-006B-App-A/B) Avail: NTIS HC A21/MF A01 CSCL 13B

Both the 1975 Federal Test Procedure and the Highway Fuel Economy Test must be conducted at ambient temperatures from 68 F (20 C) to 86 F (30 C). Since cars in service must start and run over a much broader temperature range than this, 14 selected vehicles were tested at ambient temperatures ranging from 0 F (-18 C) to 100 F (43 C) to determine how well the various car age groups and emission control technologies available today would perform at the more extreme temperatures. It was also desired to know how the use of a car's air conditioner would affect exhaust emissions and fuel economies. The results of exhaust emissions (regulated and unregulated) and fuel economies are tabulated. GRA

N80-29917# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 1: OVERVIEW Final Report, 1 Oct. 1977 - 1 Apr. 1979
Ronald E. Ruff Feb. 1980 30 p refs 4 Vol.
(Contract EPA-68-02-2770)
(PB80-178346; Rept-6868-FR-Vol-1;
EPA-600/4-80-013A-Vol-1) Avail: NTIS HC A03/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The theory and programming of statistical tests for evaluating the Real-Time Air-Quality Model (RAM) using the Regional Air Pollution Study (RAPS) data base are fully documented. Moreover, the tests are generally applicable to other model evaluation problems. An overview of the tests, displays, software, and application of the resulting statistical package are presented. GRA

N80-29918# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 2: STATISTICAL PROCEDURES Final Report, 1 Oct. 1977 - 1 Apr. 1979
Harold S. Javitz and Ronald E. Ruff Feb. 1980 57 p refs 4 Vol.
(Contract EPA-68-02-2770)
(PB80-178353; Rept-6868-FR-Vol-2;
EPA-600/4-80-013B-Vol-2) Avail: NTIS HC A04/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The tests considered for evaluating air quality simulation models in general and those that would be useful in evaluating the RAM are presented. The capability of the RAM to predict sulfur dioxide (SO2) concentrations was of particular interest. Specific tests for both intermediate and final evaluations are recommended, with accompanying descriptions of formats, plots, and procedures to establish confidence limits. Discussion focuses on the mathematics, procedures, and interpretation of the individual tests; their relevance to the project objectives; and possible trade offs among tests. GRA

N80-29919# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 3: USER'S GUIDE Final Report, 1 Oct. 1977 - 1 Apr. 1979
Ronald E. Ruff, Hisao Shigeishi, and Rodney H. Allen (Comp-Aid, Inc., Research Triangle Park, N.C.) Feb. 1980 141 p refs 4 Vol.
(Contract EPA-68-02-2770)
(PB80-178361; Rept-6868-FR-Vol-3;
EPA-600/4-80-013C-Vol-3) Avail: NTIS HC A07/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The software used in the statistical tests for evaluating the RAM is presented. Six statistical tests are described, with attention to the programming philosophy behind them. Also presented is a review of the auxiliary software that sort, retrieve, format, and display the data. GRA

N80-29920# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.
EVALUATION OF THE REAL-TIME AIR-QUALITY MODEL USING THE RAPS (REGIONAL AIR POLLUTION STUDY) DATA BASE. VOLUME 4: EVALUATION GUIDE Final Report, 1 Oct. 1977 - 1 Apr. 1979
Ronald E. Ruff Feb. 1980 59 p refs 4 Vol.
(PB80-178379; Rept-6868-FR-Vol-4;
EPA-600/4-80-013D-Vol-4) Avail: NTIS HC A04/MF A01; also available in set of 4 reports HC E12 as PB80-178338 CSCL 04A

The application and interpretation of the statistical programs, particularly with regard to use on the RAM is discussed. In general, there is no set procedure for evaluating an air quality model because of the different reasons for evaluating models and many subjective decisions to be made during the process. However, guidelines are presented to cover a wide variety of evaluation needs, with attention to data preparation, classification, analysis, selection and application of tests, and interpretation of results. Several methods of diagnosing causes of poor model performance are discussed and some sample program outputs are also provided. GRA

N80-29921# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY

GAS TURBINE ENGINES. VOLUME 1: REVIEW AND PRELIMINARY EVALUATION Final Report, Dec. 1975 - Sep. 1976
Stanley A. Mosier and Robert M. Pierce Jan. 1980 49 p refs 2 Vol.
(Contract EPA-68-02-2136)
(PB80-175599; FR-11405-Vol-1; EPA-600/7-80-017A-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13B

Duty cycles were analyzed to identify current and projected dominant operating modes and requirements of stationary gas turbine engines. These analyses indicate that as compression ratios and turbine inlet temperatures are increased to improve thermal efficiency, uncontrolled NOx emissions can be expected to double in 10 years and triple in 20 years. An extensive survey was made of candidate combustor concepts, and an analytical study was made from which those concepts considered to have significant potential for reducing production of NOx were identified. An initial compilation of 26 combustor design concepts was assembled, indicating potential for controlling NOx from clean fuels and/or fuels containing significant amounts of bound nitrogen. GRA

N80-29922# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ADVANCED COMBUSTION SYSTEMS FOR STATIONARY GAS TURBINE ENGINES. VOLUME 2: BENCH SCALE EVALUATION Final Report, Sep. 1976 - Jan. 1978
Robert M. Pierce, Stanley A. Mosier, Clifford E. Smith, and B. S. Hinton Jan. 1980 384 p ref 2 Vol.
(Contract EPA-68-02-2136)
(PB80-175607; FR-11405-Vol-2; EPA-600/7-80-017B-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 13B

Results from the testing program identified two design approaches capable of significant emission reduction. A staged centertube design, relying on burner operation near the lean blowout limit, gave low NOx and CO emissions on clean no. 2 fuel oil, but was ineffective for fuels containing bound nitrogen. A rich-burn/quick-quench (RB/QQ) design, producing a fuel-rich primary zone and quickly quenching the effluent from that region to the high overall excess air conditions required by the gas turbine cycle, successfully controls NOx from both thermal and fuel-bound sources while maintaining low CO emissions for high thermal efficiency. The RB/QQ concept was selected for scaleup to full size hardware. GRA

N80-29923# TRW, Inc., Redondo Beach, Calif.
RESIDUAL OXIDANTS REMOVAL FROM COASTAL POWER PLANT COOLING SYSTEM DISCHARGES: FIELD EVALUATION OF SO2 ADDITION SYSTEM Final Report, Jan. - Nov. 1979
K. Scheyer and G. Houser Mar. 1980 42 p refs
(Contract EPA-68-02-2613)
(PB80-170764; EPA-600/7-80-049) Avail: NTIS HC A03/MF A01 CSCL 13B

Samples of unchlorinated, chlorinated, and dechlorinated cooling water were obtained at Pacific Gas and Electric's Potrero power plant in San Francisco. An amperometric titrator was used for field analysis of total oxidant residual (TOR) and free oxidant residual (FOR). Analytical results, plant operating data, and laboratory experiments were used to evaluate the dechlorination system. Major conclusions include: (1) the dechlorination system studied showed effective removal of residual oxidants from chlorinated sea water used in the power plant cooling systems; (2) the dechlorination system proved reliable (no measurable oxidant residual was found at the effluent outfall); and (3) due to the effectiveness of the dechlorination system in removing all measurable oxidant residual, average and maximum levels of dechlorination cannot be determined. GRA

N80-29924# Systems Applications, Inc., San Rafael, Calif.
MODELING OF SIMULATED PHOTOCHEMICAL SMOG WITH KINETIC MECHANISMS, VOLUME 1 Final Report, Jul. 1978 - Sep. 1979
G. Z. Whitten, J. P. Killus, and H. Hogo Feb. 1980 364 p refs
(Contract EPA-68-02-2428)
(PB80-175102; EF79-124-Vol-1; EPA-600/3-80-028A) Avail: NTIS HC A16/MF A01 CSCL 07E

Mechanisms that describe the formation of photochemical smog are developed using a computer modeling technique directed toward the simulation of data collected in two smog chambers: an indoor chamber and a dual outdoor chamber. The results of simulating 164 different experiments are presented. Individual compounds for which specific experiments were simulated and mechanisms developed include the following: formaldehyde, acetaldehyde, ethylene, propylene, butane, and toluene. The mechanisms reported describe the decay of the precursor organic compound, formation and decay of secondary organic compounds, conversion of nitrogen oxides, formation of nitrates, and the appearance and decay of ozone. GRA

N80-29925# Ohio State Univ., Columbus. Dept. of Chemistry.
KINETIC STUDIES OF SIMULATED POLLUTED ATMOSPHERES Final Report, Jan. 1976 - Apr. 1979
Jack G. Calvert Jan. 1980 281 p refs
(Grant EPA-R-804348)
(PB80-176787; EPA-600/2-80-024) Avail: NTIS HC A13/MF A01 CSCL 04A

The kinetics and reaction mechanisms of several important atmospheric contaminants, SO2, formaldehyde, nitrous acid, and the nitrosamines, were assessed to help quantify some key aspects of the chemistry of polluted atmospheres. The reactions and lifetimes of excited sulfur dioxides with various atmospheric components including hydroxyl, hydroperoxy, and methylperoxy radicals were studied. These data and other published rate data were reviewed and evaluated. The photolysis of formaldehyde was investigated as a major source of hydroperoxyl radicals, and a quantitative evaluation made of its apparent first order rate constants at various solar zenith angles. The absolute extinction coefficients for nitrous acid were determined, and estimates made of the rates of hydroxyl radical generation in the troposphere by photolysis of nitrous acid. Long path Fourier transform infrared spectroscopy was used to help evaluate the potential for nitrosamine formation in the polluted atmosphere. GRA

N80-29926# Kansas Water Resources Research Inst., Manhattan.
SOLUBILITY OF SELECTED MAJOR AND MINOR ELEMENTS FROM COAL AND FLY ASH ACCUMULATIONS Completion Report, Jul. 1977 - Sep. 1979
D. A. Kposick and Ernest E. Angino Mar. 1980 29 p
(PB80-175334; W80-04604; OWRT-A-087-KAN-1) Avail: NTIS HC A03/MF A01 CSCL 13B

Different fly and bottom ashes, representing four coal producing areas of the United States were used in leaching experiments for Ca, Mg, Na, K, Fe, Mn, Zn, Cu, Pb, and Cd and the potential for contamination of ground and surface water supplied by these elements. Both fly ash and bottom ash are formed by the thermal decomposition or dehydration of inorganic impurities in coal and vary with the type of coal used. Many factors affect leachate characteristics such as coal preparation methods, method and efficiency of combustion, method of disposal, particle morphology, and others. GRA

N80-29927# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. foer Vattenbyggnad
DESCRIPTION AND VALIDATION OF THE CTH-URBAN RUNOFF MODEL
Viktor Arnell 1980 193 p refs
(PB80-181480; SER-A-5; ISSN-0348-1050) Avail: NTIS HC A09/MF A01 CSCL 13B

The structure, function, and validation of the CTH-Urban Runoff Model are described. It is a design/analysis model and includes the processes of infiltration, surface depression storage, overland flow, gutter flow, pipe flow, and retention storage. Infiltration is calculated by Horton's equation and depression storage supply is calculated by an exponential relationship. Overland flow and pipe flow are calculated according to a kinematic wave theory and the outflow from the retention basin is a function of the water depth in the basin. The CTH-Model was validated by simulation of the runoff for 10-20 measured rainfalls in each of six urban residential areas. GRA

N80-29928# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

ENERGY/ENVIRONMENT 4: PROCEEDINGS OF THE NATIONAL CONFERENCE ON THE INTERAGENCY ENERGY/ENVIRONMENT R AND D PROGRAM Decision Series
Francine S. Jacoff, Elinor Voris, and Gary M. Sitek Oct. 1979 311 p refs Conf. held in Washington, D.C., 7-8 Jun. 1979 (Contract EPA-68-01-2934)
(PB80-177942; EPA-600/9-79-040) Avail: NTIS HC A14/MF A01 CSCL 13B

An update of interagency research programs in particular areas, including health effects, transport processes and ecological effects, mining methods and reclamation, control technology and integrated technology assessment is given. GRA

N80-29929# Environmental Protection Agency, Las Vegas, Nev. Exposure Assessment Div.
LEAD PARTICLES IN THE GREAT SMOKEY MOUNTAINS BIOSPHERE RESERVE Interim Report
G. B. Wiersma, C. W. Frank (Iowa Univ.), K. W. Brown, and C. I. Davidson (Carnegie-Mellon Univ.) Jan. 1980 19 p refs
(PB80-170004; EPA-600/4-80-002) Avail: NTIS HC A02/MF A01 CSCL 13B

Remote air monitoring using 0.45 micrometer millipore filters at eight remote sites in the Great Smokey Mountains National Park has shown that lead particulates are contributing to the contamination of this designated biosphere reserve. Analytical results of these filters by atomic absorption spectrophotometry, X-ray fluorescence, and scanning electron microscopy showed that lead air concentrations varied frm a high of 141 ng/cu m to low of 18.9 ng/cu m. The spherical shape of the lead particulates indicates that the moieties were formed by high temperature processes, such as by internal combustion engines. Also, the small particulate size may indicate long range transport and subsequent deposition from urban and/or industrialized areas. GRA

N80-29930# Wisconsin Univ. - Madison. Sea Grant Coll. Program.
THE INVISIBLE MENACE: CONTAMINANTS IN THE GREAT LAKES Annual Report
Christine Kohler, Whitney Gould, and Warren Downs Mar. 1980 66 p refs
(PB80-181662; WIS-SG-80-133; NOAA-80041107) Avail: NTIS HC A04/MF A01 CSCL 13B

During the past three years, special attention was given to the activities related to toxic substances. Sea Grant's many other programs and research projects, ranging from aquaculture and policy studies to diving physiology and ocean engineering, are profiled later in this report. GRA

N80-29931# California Univ., Berkeley. Statewide Air Pollution Research Center.
PHOTOCHEMICAL OXIDANT AIR POLLUTION EFFECTS ON A MIXED CONIFER FOREST ECOSYSTEM Final Report
R. N. Kickert, J. R. McBride, P. R. Miller, C. P. Ohmart, O. C. Taylor, ed., R. J. Arkley, D. L. Dahlsten, F. W. Cobb, Jr., J. R. Parmeter, Jr, R. F. Luck et al Jan. 1980 215 p refs
(Contract EPA-68-03-2442)
(PB80-176779; EPA-600/3-80-002) Avail: NTIS HC A10/MF A01 CSCL 06F

Effects for the year 1976-1977 are presented. Subsystems which received greatest attention during this study were: major free species response to oxidant dose, tree population dynamics, tree growth, moisture dynamics, soil chemical and physical properties, tree mortality relative to disease, insects and other factors, epidemiology of forest tree pathogens with emphasis on Fomes annosus, cone and seed production, tree seedling establishment, litter production and litter decomposition relative to microfloral decomposer populations. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-29932 Michigan Univ., Ann Arbor.
INCOHERENT SCATTERING OF RADAR WAVES IN THE AURORAL IONOSPHERE Ph.D. Thesis
R. S. Venkat Raman 1980 251 p
Avail: Univ. Microfilms Order No. 8017343

The effects of such nonMaxwellian ion velocity distributions on the spectrum of radiation incoherently scattered by the ionosphere are systematically studied in terms of the parameter(s) responsible for the formation of these nonMaxwellian ion velocity distributions. The region of the ionosphere of interest is restricted to altitudes above about 150 km where the various ion neutral collision frequencies are very small compared to the ion gyrofrequency. It is found that the shape of the incoherent scatter spectrum depends on the magnitude of the dc electric field, the electron to ion temperature ratio, and phi - the angle between the radar probing direction and the magnetic field. For a given nonzero value of phi and constant electron ion temperature ratio, the shape of the incoherent scatter spectrum departs increasingly from the characteristic Maxwellian spectral shape (assuming the electron and ion distribution to be Maxwellian) as the electric field increases. The departures from the Maxwellian spectral shape also become more prominent as the angle between the line of sight and the magnetic field increases. Dissert. Abstr.

N80-29933 Rice Univ., Houston, Tex.
JICAMARCA RADAR MEASUREMENTS OF WINDS AND TURBULENCE IN THE STRATOSPHERE Ph.D. Thesis
Daniel Alfred Fleisch 1980 108 p
Avail: Univ. Microfilms Order No. 8018050

A series of 48 hour experiments performed quarterly in 1977 to study radar returns from the lower stratosphere are described. Current theories of stratospheric scatter of radio waves are presented and the radar equation pertinent to the large array at Jicamarca, Peru is derived. Observational and data reduction techniques are discussed. Experimental results concerning scattered power, mean wind velocities, and velocity fluctuations are presented. It is found that isotropic turbulent scatter is not the only scattering mechanism operating in the stratosphere, and modifications to the radar equation which arise from turbulent rolls or thin layers of refractive index variation are needed. Mean winds measured by radar are comparable to those determined by rawinsonde ascent. Velocity oscillations of approximately 5 minute periods are interpreted as buoyancy oscillations with 2 km horizontal wavelength and phase velocity of 6 m/s. Tidal oscillations with periods of 24 and 12 hours are also observed. Suggestions for future measurements at Jicamarca and other institutions are offered. Dissert. Abstr.

N80-29934 Rice Univ., Houston, Tex.
SIMULTANEOUS GROUND AND ROCKET BASED MEASUREMENTS OF ELECTRIC FIELDS AND CURRENTS IN AN AURORAL ARC Ph.D. Thesis
Robert Melvin Robinson 1980 143 p
Avail: Univ. Microfilms Order No. 8018086

A Terrier-Malemute sounding rocket was launched into a stable, premidnight auroral arc carrying a cesium vapor magnetometer, electrostatic curved-plate electron energy analyzers, and two sets of Langmuir double probes. Simultaneous line-of-sight velocity and electron density measurements were made during the flight by Chatanika radar operating in an elevation scan mode in the magnetic meridian. Data from the magnetometer indicated that a broad region of eastward current flowed within the diffuse aurora equatorward of the arc, while westward current flowed within the arc itself. The field aligned current was downward in the diffuse aurora and uniformly upward in a 100 km wide region which contained the arc. The double probe measured a 40 mV/m northward electric field just equatorward of the arc. Within the arc the northward electric field was zero. The tangential component of the electric field was 7 mV/m and was constant across the arc boundaries. The simultaneous measurements enabled the association of the aurora with large scale regions in the magnetosphere. They also showed the construction of a self consistent perpendicular current system for the arc involving a time varying neutral wind. Dissert. Abstr.

N80-29935 Michigan Univ., Ann Arbor.
DIRECT MEASUREMENTS OF OZONE AND NITROGEN

DIOXIDE PHOTOLYSIS RATES IN THE ATMOSPHERE Ph.D. Thesis
Russell Robert Dickerson 1980 214 p
Avail: Univ. Microfilms Order No. 8017246

All atmospheric chemistry, including stratospheric ozone chemistry and tropospheric smog chemistry, is powered by photolysis reactions. Models of the atmosphere demand accurate, reliable photolysis rates which are often unavailable from calculations. The design, development, chemistry and results of flow actinometers used to measure atmospheric photolysis rates directly, and electronic UV photometers designed or modified to give a response directly related to photolysis rates are described. These photometers measured albedos of many surfaces at altitudes from 0.6 km. While natural surfaces such as vegetation and oceans have a UV albedo near zero, dense clouds and snow have an albedo near one. With increasing altitude, molecular, and particulate scattering often increase the effective albedo with respect to photolysis rates. The effective albedo over the ocean is 7% at 0.05 km and 25 to 45% at 5.0 km for varying amounts of haze. The rate of photolysis of ozone to O(1D), is measured in a flow of ozone in nitrous oxide. The rate of NO2 photolysis is measured in a flow of NO2 in air or O2. Direct photolysis rate measurements indicate a strong zenith angle dependence.
Dissert. Abstr.

N80-29936 Stanford Univ., Calif.
WATER DISPERSION AND ABSORPTION IN PARTIALLY SATURATED ROCKS Ph.D. Thesis
John Wesley DevilbissMunoz 1980 140 p
Avail: Univ. Microfilms Order No. 8016819

Results from laboratory experiments suggest that the ratio of compressional to shear acoustic wave amplitude is a practical and useful diagnostic for underground steam. The compressional to shear wave propagation velocity ratio is also an indicator of partial pore saturation but the changes expected for this parameter are shown to be small in sedimentary regimes although it may be useful in volcanic or igneous intrusive geological provinces. The large changes in the amplitude ratio are such that the measurement of the velocity ratio will be difficult in partially saturated rocks in situ. Compressional and shear waves propagation velocities have been measured accurately at a temperature of 150 degrees centigrade with respect to varying degrees of saturation. It was found that the variations of compressional wave propagation velocities agree qualitatively with published theories of wave propagation in rocks. The variations of shear wave propagation velocities indicate that at the frequency of the measurements the effective shear modulus is sensitive to the presence of water in the pores. This has not been recognized experimentally or quantitatively in theory in the past. The magnitude of the change in effective shear modulus of the rock was found to vary with the permeability of the sample suggesting a possible fluid flow mechanism for the effect. Nevertheless, another mechanism, viscous shear relaxation, also can explain the phenomenon.
Dissert. Abstr.

N80-29937 Columbia Univ., New York.
THE NATURE OF THE EARTHQUAKE FOCUS AS INFERRED FROM BODY-WAVE OBSERVATIONS Ph.D. Thesis
John Lord Boatwright 1979 220 p
Avail: Univ. Microfilms Order No. 8016901

A class of kinematic rupture models is constructed to approximate numerical and analytical solutions to the dynamic problem of shear fracture. These models incorporate self-similar rupture growth, a range of stopping behavior and causal healing, which propagates into the interior of the rupture areas at the compressional wave velocity. The far field body waves radiated by these models are analyzed to determine simple techniques for estimated source dimension and dynamic stress drop. The effects of rupture velocity and rupture geometry on the directivity of the body wave pulse shapes are also investigated. These results are applied to the analysis of two high stress drop earthquakes which occurred beneath Shumagin Islands, Alaska, and of a multiply recorded aftershock of the 1975 Oroville, California earthquake. The stopping phases radiated by the Oroville aftershock are analyzed in order to investigate the unmodelled complexity of the rapture. The combination of the results from these two techniques provides the most detailed description of rupture ever obtained for a moderate-sized earthquake.
Dissert. Abstr.

N80-29938 Illinois Univ. at Urbana-Champaign.
APPLICATIONS OF HYDROGRAPH TRANSFORMATION TO HYDRODYNAMIC PROBLEMS INFLUENCED BY GRAVITATION Ph.D. Thesis
Taeyoung Han 1980 138 p
Avail: Univ. Microfilms Order No. 8017947

The hydrodynamic problems influenced by gravitation were examined through hodograph transformations. It was found that even with strong influence of the gravitational field, the stream function can be solved in the hodograph plane through numerical calculations. The velocity function of free streamlines must be determined through iteractions and it was also found that this iterative process is rapidly convergent. Favorable agreement of the results with the experimental data substantiates the fact that this method is effective in dealing with flow problems strongly influenced by gravitation. The idea of subdividing the hodograph and matching their boundary values along the cut can be extended to problems with more complicated configurations.
Dissert. Abstr.

N80-29939# Indian Space Research Organization, Bangalore.
SPACE SCIENCE RESEARCH IN INDIA. PART 1: EARTH'S ENVIRONMENT AND GEOMAGNETISM
P. Sharma, D. P. Sharma, M. S. Narayanan, and S. K. Mattoo Oct. 1978 176 p refs
(ISRO-SR-06-78) Avail: NTIS HC A09/MF A01

Space science research activities being conducted at various institutions in India are reported and important scientific results obtained since 1965 are summarized. All branches of aeronomy and astronomy (including astrophysics) studied either by ground-based or spaceborne techniques are considered as well as theoretical/analytical studies. Categories covered include: meteorology; atmospheric emissions; D-region; E-region; F-region and topside ionosphere; total electron content of the ionosphere; ionospheric scintillations; ionospheric drifts; gravity waves and travelling ionospheric disturbances; lunar tidal variations; radio communications; geomagnetism; and the Earth's magnetosphere.
A.R.H.

N80-29940*# Texas Univ. at Dallas, Richardson. Center for Space Sciences.
THE RELATIONSHIPS BETWEEN HIGH LATITUDE CONVECTION REVERSALS AND THE ENERGETIC PARTICLE MORPHOLOGY OBSERVED BY THE ATMOSPHERE EXPLORER
R. A. Heelis, J. D. Winningham, W. B. Hanson, and J. L. Burch (Southwest Research Inst., San Antonio, Tex.) [1980] 33 p refs
(Contract NAS5-11407; Grant NsG-5085)
(NASA-CR-163429) Avail: NTIS HC A03/MF A01 CSCL 04A

Simultaneous measurements of the auroral zone particle precipitation and the ion convection velocity by Atmosphere Explorer show a consistent difference between the location of the poleward boundary of the auroral particle precipitation and the ion convection reversal. The difference of about 1.5 degrees of invariant latitude is such that some part of the antisunward convection lies wholly within the auroral particle precipitation region. The nature of the convection reversals within the precipitation region suggests that in this region the convection electric field is generated on closed field lines that connect in the magnetosphere to the low latitude boundary layer. Author

N80-29941*# Naval Research Lab., Washington, D. C. Center for Space Research.
F REGION ABOVE KAUI: MEASUREMENT, MODEL, MODIFICATION
C. Y. Johnson, G. W. Jolander, E. S. Oran, T. R. Young, P. A. Bernhardt, and A. V. daRosa 18 Mar. 1980 43 p refs Prepared in cooperation with Johns Hopkins Univ., Laurel, Md. and Stanford Univ., Calif.
(Grant NGR-05-020-001; Contract N00173-77-C-0091; RR0330204)
(NASA-CR-163318; AD-A084556; AD-E000403; NRL-MR-4186) Avail: NTIS HC A03/MF A01 CSCL 04/1

Prior to an explosive chemical release, a rocket-borne ion mass spectrometer and dual-frequency beacon measured the ion composition and electron content of the undisturbed F region above Kauai, Hawaii. These results are compared to a detailed calculation of ionospheric ion densities. Considerable H2O outgassing produced measurable 18(+) (H2O) and 19(+) (H3O) currents which together with O(+) current were used to determine the H3O(+) H2 O(+) dissociative recombination rate ratio. The explosive event at 283 km swept clean a 1 km radius region. The boundary of the ionic void was characterized by a steep gradient in the ion density. Results for the first 60's after the event are presented which show changes in ambient ion species 14(+), 16(+), 30(+) and 32(+), new reactant species 15(+), 17(+), 18(+), 19(+), 27(+) and 46(+), and evidence of ionic depletion by sweeping. GRA

N80-29942# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
FOURIER SERIES ON SPHERES: A GEOMETRIC PERSPECTIVE Environmental Research Papers. Interim Report
Samuel V. K. Yee 15 Jan. 1980 16 p refs
(AD-A084484; AFGL-TR-80-0021; AFGL-ERP-692) Avail: NTIS HC A02/MF A01 CSCL 04/1

A new function for the Fourier decomposition of a scalar function on spheres is derived from geometric considerations. The function is amenable to fast transforms and is useful as a basis function in spectral simulation and prediction global atmospheric flows. This new expression is shown to belong to a family of such expressions that consists of two other known members. A brief comparison is made among the three in the family. GRA

N80-29943# Naval Research Lab., Washington, D. C.
PLUMEX 1: COINCIDENT RADAR AND ROCKET OBSERVATIONS OF EQUATORIAL SPREAD
E. P. Szuszczewicz, R. T. Tsunoda, R. Narcisi, and J. C. Holmes 17 Mar. 1980 28 p refs Sponsored by Defense Nuclear Agency and AFOSR
(RR0330244)
(AD-A085472; AD-E000430; NRL-MR-4201) Avail: NTIS HC A03/MF A01 CSCL 04/1

Coordinated measurements of equatorial spread-F conducted during July 1979 at the Kwajalein Atoll have yielded the first definitive space and time coincident radar and rocket observations of small scale irregularities and large scale plasma depletions. The results have shown that: (a) within a large-scale topside F-layer depletion radar backscatter energy is at a level much lower than that observed on the depletion's topside. The same is true of 'in situ' irregularity observations, and (b) ion composition within a topside depletion can provide signatures of its bottomside source domain and estimates of average maximum vertical drift velocity. For long-lived depletions, molecular ion signatures (NO(+) and O2(+)) can be lost while bottomside levels of N(+) can be maintained when O(+) approximately equals N sub e much greater than NO(+) - O2(+), and finally, (c) large scale fluctuations of O(+) accompanied by a near-constant level of NO(+) and O2(+) on the bottomside F-layer gradient suggests that neutral atmospheric turbulence is not a major source for bottomside ionospheric plasma irregularities. GRA

N80-29944# Logicon, Inc., Lexington, Mass.
ANALYTIC REPRESENTATION OF THE JACCHIA 1977
James N. Bass Hanscom AFB, Mass. AFGL 25 Jan. 1980 14 p refs
(Contract F19628-78-C-0209; AF Proj. 9993)
(AD-A085781; SR-2; AFGL-TR-80-0037) Avail: NTIS HC A02/MF A01 CSCL 04/1

Modified Jacchia-Walker temperature profiles are developed to accurately represent the Jacchia 1977 temperature profiles above 125 km. The diffusive equilibrium equations are analytically integrable for these profiles, greatly reducing the need for tabular storage of solutions. GRA

N80-29945# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLUORESCENCE EXPERIMENT AND AURORAL DATA EVALUATION TO IMPROVE PREDICTION OF NUCLEAR ATMOSPHERIC INFRARED BACKGROUND Final Report, 2 Feb. 1978 - 28 Feb. 1979
J. B. Kumer and T. C. James 28 Feb. 1979 117 p refs
(Contract DNA001-78-C-0082)
(AD-A085724; AD-E300789; LMSC-D0673384; DNA-4906F) Avail: NTIS HC A06/MF A01 CSCL 04/1

The report documents coordinated laboratory and data evaluation research efforts which are relevant to the DNA program for developing capability to predict nuclear enhanced atmospheric infrared background radiance. The laboratory effort involves the use of a dye laser pumped LiNb03 optical parametric oscillator in order to produce a tunable source of intense 2.7 micron light for the purpose of laboratory simulation of the infrared effects of solar or nuclear illumination of the atmosphere. The source is used to excite the specie C02(101) which can re-radiate at 2.7 micron via 101 yields 000 or at 4.3 micron via 101 yields 100, the latter process is predicted to be a major nuclear effect at 4.3 micron under certain conditions since theoretically it is predicted to occur more often than the former by ratio 20:1. A primary purpose of our laboratory effort was to confirm this prediction, our initial results place a lower limit of 10:1 on the branching ratio. This low precision result can be enhanced by utilizing simple techniques that were not within the scope of the initial effort, namely by the use of (1) well documented techniques for improving laser frequency stability, (2) a cooled 2.7 micron filter mounted in the detector dewar, (3) a multiple pass fluorescence cell, and (4) faster electronics for recording the 2.7 micron signal. Implementation of these techniques should improve the precision of the measurement by more than 2 orders of magnitude. Additionally, the initial effort has demonstrated the applicability of the laser source and peripheral vacuum and electronic equipment for the high precision measurements of quenching and vibration transfer rate coefficients. GRA

N80-29946# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
STUDIES OF TRANSIONOSPHERIC SCINTILLATION USING ORBITING SATELLITE DATA Scientific Report, Jul. 1979 - Jul. 1980
Stanley Brittain Quinn, Jr. Hanscom AFB, Mass. AFGL Apr. 1980 73 p refs
(Contract F19628-78-C-0195; AF Proj. 4643)
(AD-A085448; UILU-ENG-80-2539; AFGL-TR-80-0092; SR-2) Avail: NTIS HC A04/MF A01 CSCL 04/1

Multi-frequency studies of transionospheric radio signals fluctuations are facilitated by the DNA Wideband Satellite Experiment run by SRI International. Mutually coherent signals were recorded at equatorial, mid-latitude and auroral stations. Results including statistical parameters of the received signals as well as what they reveal about the ionosphere are discussed. Correlations and power spectra of the signals are also computed. GRA

N80-29947# SRI International Corp., Menlo Park, Calif.
HIGH-LATITUDE SCINTILLATION MORPHOLOGY, ALASKAN SECTOR Topical Report, 1 May 1978 - 1 Apr. 1978
Stephen J. Matthews and Charles L. Rino 1 Oct. 1979 53 p refs
(Contract DNA001-77-C-0220)
(AD-A086222; AD-E300808; DNA-5131T) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes the auroral-zone scintillation morphology as deduced from two years of observations made at Poker Flat, Alaska, using the DNA Wideband satellite. The data confirm that magnetic activity is the principal factor in determining the level of both nighttime and daytime auroral-zone scintillation. No systematic seasonal variation in activity was found, although the second year (1977-1978) showed a significant increase in overall activity when compared with the first year (1976-1977). This increase is correlated with the general increase in solar activity, with the approach of the expected solar cycle maximum around 1980. The average latitudinal distribution of the nighttime scintillation activity shows a pronounced enhancement at the point where the propagation path intercepts the local L shell. The scintillation enhancement is more prominent in the phase scintillation data; this has been attributed primarily to a geometrical effect, although there is evidence of a columnar F-region source that has contributed as well. GRA

N80-29948# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
MODELS FOR THE AEROSOLS OF THE LOWER ATMOSPHERE AND THE EFFECTS OF HUMIDITY VARIATIONS ON THEIR OPTICAL PROPERTIES Environmental Research Paper
Eric P. Shettle and Robert W. Fenn 20 Sep. 1979 94 p refs (AF Proj. 7670)
(AD-A085951; AFGL-TR-79-0214; AFGL-ERP-676) Avail: NTIS HC A05/MF A01 CSCL 04/1

Aerosol models have been developed for the lower atmosphere. These models are representative of conditions found in rural, urban, and maritime air masses. The changes in the aerosol properties with variations in the relative humidity are discussed. To describe the aerosol optical properties in the extreme of 100 percent relative humidity, several fog models are presented. For each model the coefficients for extinction, scattering, and absorption, the angular scattering distribution, and other optical parameters have been computed for wavelengths between 0.2 and 40 microns. These aerosol models are presented together with a review of their experimental basis. The optical properties of these models are discussed and some comparisons of the model with experimental measurements are presented. GRA

N80-29949# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
A METHOD TO PREDICT THE PARAMETERS OF A FULL SPECTRAL DISTRIBUTION FROM INSTRUMENTALLY TRUNCATED DATA Environmental Research Paper
Robert O. Berthel 7 Jan. 1980 47 p refs
(AF Proj. 6670; AF Proj. 2310)
(AD-A085950; AFGL-TR-80-0001; AFGL-ERP-689) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report describes a method of correcting measured hydrometeor distributions that are deficient in large-size particles because of instrument truncation. The corrective technique is developed with the analysis of experimental data and the application of the exponential-distribution function. A discussion is presented on the power-function equations used to define hydrometeor environments and the application of the corrected spectra to these mathematical relationships. Equations are presented for the real-time analysis of truncated distribution to provide estimates of the non-truncated spectra. GRA

N80-29950# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Physikalische Weltraumforschung.
SOUNDING ROCKET PROGRAM IN AERONOMY: ELECTRON DENSITY EXPERIMENT BASED ON THE DISPERSIVE DOPPLER EFFECT Final Report
Logar Unger Bonn Bundesmin. fuer Forsch u. Technol. Nov. 1979 67 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-19) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13.65

The electron content between a transmitter on the ground and a receiver on a rocket was accurately determined. Different approaches to applying this technique were examined. The importance of the noise situation onboard the rocket as a decisive factor in selecting the type of receiver was emphasized. Applying modulation at the ground transmitter and using a rather low first frequency, the device was able to give the slant range to the receiver on board as well as the electron content down to electron densities of about 10 million/cu cm. Measured electron density profiles were measured including one obtained during winter anomaly conditions and one during a proton event. The hardware on board the rocket and on the ground as well as the computer program (ALADDIN) used to process the radio signals are also described in detail. Author (ESA)

N80-29951# International Meteorological Inst., Stockholm (Sweden).
[RESEARCH ACTIVITIES IN METEOROLOGY IN SWEDEN FROM JULY 1978 TO JUNE 1979] Annual Report
Nov. 1979 31 p refs
(AR-78-79) Avail: NTIS HC A02/MF A01

Research continuing or completed in 1979 is reported in dynamic meteorology, climatology, and geophysical fluid mechanics as well as atmospheric chemistry and atmospheric physics. Noteworthy results in the modeling of moisture, condensation, cloud formation and dissipation are discussed. Information on the chemical composition of the atmosphere is given. Aeronomy research results are also described. Author (ESA)

N80-29952# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 2: WORKING GROUP REPORT AND REVIEWS
Richard F. Donnelly, ed. Dec. 1979 747 p refs Conf. held at Boulder, Colo., 13-17 Apr. 1979
(PB80-183361; NOAA-80040404-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 04A

The main results of the workshop and the recommendations of the working groups are presented. Three types of papers are included: (1) working group reports; (2) topical review papers; and (3) reviews of the needs for predictions by groups that use solar-terrestrial predictions. Predictions for satellite and power-system applications because of their increasing importance are emphasized. Chapter 1 discusses in depth the solar-terrestrial environment problems for spacecraft. Chapter 2 discusses the needs for solar-terrestrial predictions. Chapter 3 discusses radio communication predictions. Chapter 4 discusses solar-activity predictions. Chapter 5 discusses predictions of magnetospheric disturbances including solar-wind and magnetosphere interactions. Chapter 6 discusses ionospheric predictions. The final chapter discusses the potential for predicting climate or weather effects of solar activity. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-29953 Rice Univ., Houston, Tex.
THUNDERCLOUD ELECTRIC FIELD SOUNDINGS WITH INSTRUMENTED FREE BALLOONS Ph.D. Thesis
Mark Edward Weber 1980 134 p
Avail: Univ. Microfilms Order No. 8018091

A Balloon Electric Field Sensor released into a thunderstorm, measured the electric vector and wind profile. During a major portion of its ascent, the instrument was in an intense updraft, with a maximum vertical wind component of about 15 m/sec. Horizontal flow, at 10 to 15 m/sec towards the northeast, was encountered above 700 m (msl). The electric vector indicated that the balloon rose through an 800 m thick region of positive charge in the lower portion of the cloud. Above this, negative charge extended from 5200 m to 8200 m (msl). Intense horizontal electric field components were imputed to a volume of negative charge, situated near 6700 m (msl) where the rainfall rate was only about 3 mm/hr. Lightning subsequently discharged this volume. The cloud contained positive charge above 8200 m. Electrical corona, induced in pointed rods affixed to a radiosonde, was measured as the sonde rose through a thundercloud on 21 July 1978. Strong fields and charge of both polarities were encountered. An abrupt decline in upwards directed corona current as the instrument passed through the cloud's upper surface may have resulted from a negative screening layer. Dissert. Abstr.

N80-29954 Texas A&M Univ., College Station.
NUMERICAL MODELING OF A ROTATING CUMULONIMBUS CLOUD Ph.D. Thesis
David Ray Smith 1979 130 p
Avail: Univ. Microfilms Order No. 8011999

The processes leading to the extreme concentration of vorticity that accompany the formation of a tornado were investigated. A nonprecipitating cloud with rotation induced in the outer half of its domain was constructed to study the concentration and vertical propagation of available vorticity in a rotating mesoscale convective system. A precipitating cloud was also generated with the same characteristics of the previous cloud except the autoconversion process was activated to produce precipitation size hydrometeors. Significant results are reported.Dissert. Abstr.

N80-29955 State Univ. of New York at Albany.
A COMPARATIVE DIAGNOSTIC STUDY OF EAST COAST CYCLOGENESIS UNDER WEAK VERSUS STRONG SYNOPTIC-SCALE FORCING Ph.D. Thesis
Vito Pagnotti 1980 164 p
Avail: Univ. Microfilms Order No. 8016704

Two cases of East-Coast cyclogenesis and related east-of-Appalachian ridging--one under weak, the other strong, synoptic-scale forcing--are diagnostically compared: they form a continuum of six time periods from 0000 GMT, 22 December 1970, to 1200 GMT, 24 December 1970. A set of objective analysis schemes is used to produce grid-point analyses of observed data with a one degree latitude-longitude horizontal resolution and a 100 mb vertical resolution. The SUNYA version of Krishnamurti's balance model is modified for ten levels and applied to the data to obtain fields of vertical motion. Total and some partitioned fields of nonlinear balanced vertical motion, as well as those of cumulative hourly precipitation and moisture flux, are presented. Correlation coefficients for kinematic versus balance-model omegas are generated. In addition, various energy parameters computed using the total balance-model omegas are presented. Dissert. Abstr.

N80-29956 State Univ. of New York at Albany.
CLEAR-AIR SEEDING Ph.D. Thesis
Andrew Garold Detwiler 1980 212 p
Avail: Univ. Microfilms Order No. 8017642

An investigation is made into the prospects for nucleating widespread ice particle clouds in clear air for the purpose of moderating surface temperature extremes and modulating atmospheric convection. Using aircraft contrails as a model, it appears that on many occasions ice particle clouds can be nucleated in clear areas of the upper troposphere that will decrease the outgoing planetary infrared radiation by perhaps twice that amount, at the earth's surface. It is possible to promote the development of much more widespread cloudiness than a typical contrail by using aircraft to release large numbers of ice nuclei so that orders of magnitude more ice particles are created per unit length of flight path than are created in normal contrails. Opportunities also exist for clear air seeding near the surface in cold climates. Investigations into suitable ice nuclei, synoptic weather conditions, and seeding schemes are presented. The radiative properties of cirrus clouds are discussed. Dissert. Abstr.

N80-29957 Rice Univ., Houston, Tex.
INFRASONIC THUNDER: EXPLAINED Ph.D. Thesis
Jerry Lynn Bohannon 1980 67 p
Avail: Univ. Microfilms Order No. 8018034

The existence of infrasonic pulses induced by lightning within thunderclouds is firmly established from experimental observation. The observed waveform has a compressive pulse followed by a rarefactive pulse. It is shown that these infrasonic pulses are wholly electrostatic in origin and arise out of the interaction of the large space charges inside thunderclouds. The positive part of the pulse is due to the relaxation of the mutual attraction of the negative charge layer and the positive shielding layer beneath it during a lightning event. The negative portion of the pulse is due to the reduction in the mutual repulsion of the charged cloud particles in the negative charge storage layer. A series of calculations, done with spherical charges, is presented that describes the changes in the electrostatic potential energy in a simple thundercloud as the result of the partial neutralization of the stored charge by a lightning flash. These calculations are used to demonstrate that two competing theories, ohmic heating of the air within the charge storage region and rapid charge separation, cannot explain the amplitude of the initial positive excursion in the infrasonic waveform. Dissert. Abstr.

N80-29958 Rice Univ., Houston, Tex.
THE ROTATIONAL DYNAMICS OF ATMOSPHERIC ICE: ELECTRICAL AND AERODYNAMIC TORQUES Ph.D. Thesis
Andrew John Weinheimer 1980 132 p
Avail: Univ. Microfilms Order No. 8018092

The rotational motion of atmospheric ice particles is analyzed to determine the conditions under which the particles align with atmospheric electric fields. The particle shapes are approximated by prolate and oblate spheroids and may be treated as conductors or dielectrics, depending on the speed of the rotation in relation to the electric response times. At low Reynolds numbers, the electrical torque is opposed by a Stokes drag torque. The resulting equation of motion is that of a damped pendulum oscillator. At higher Reynolds numbers, the electrical torque competes with an aerodynamic torque which itself attempts to produce an alignment of the ice crystals not necessarily compatible with that for the electrical torque. The dynamics of a spectrum of ice particle shapes and sizes in a wide range of electric fields is examined. Numerical values are obtained for the relevant characteristic times and torque ratios, and the different dynamical regimes are delineated. It is found that electric fields of at least 1 kV/m, or perhaps 10 kV/m, are required to produce significant alignment. Dissert. Abstr.

N80-29959 Wyoming Univ., Laramie.
STATISTICAL DISTRIBUTION OF WAVE HEIGHTS AND PERIODS FOR HURRICANE WAVES Ph.D. Thesis
Elizabeth Yang Chen 1979 144 p
Avail: Univ. Microfilms Order No. 8018001

Water level elevations recorded during hurricanes Carla (1961) and Camille (1969) are utilized for the statistical analysis of the probability distributions for wave heights and periods. It is found that the Rayleigh distribution under the narrow band assumption, can describe the observed wave height distribution very well at low and moderate wave heights. The deviations from the Rayleigh distribution at higher waves may be compensated for by empirical corrections. A detailed analysis of the 'bump-count' waves leads to a basic procedure for characterizing the conditional distribution for wave period given the height. A good approximation to this conditional law is a normal density, truncated on the left at-period associated with breaking waves of that heat. Two significant characteristics observed for an empirical study of the periods associated with the larger wave heights in hurricanes are: (1) the average period, regarded as a function of wave height, seem to be roughly constant for heights greater than the significant wave height, and (2) the standard deviation of wave period of these waves decreases with increasing wave height. Dissert. Abstr.

N80-29960 Florida Univ., Gainesville.
PROPERTIES OF LIGHTNING DERIVED FROM TIME SERIES ANALYSIS OF VHF RADIATION DATA Ph.D. Thesis
Pedro Luis Rustan, Jr. 1979 386 p
Avail: Univ. Microfilms Order No. 8016578

Lightning properties are derived by correlating three dimensional VHF source locations, characteristics of the VHF (30 to 50 MHz) radiation, and electric field intensity (0.1 Hz to 1.5 MHz). The discharge initiation, propagation, overall geometry, and charge magnitude and location for the various phases of both cloud-to-ground and intracloud lightning are studied. Four cloud-to-ground and three intracloud flashes, all selected randomly are analyzed. The three dimensional source locations presented for the different phases of lightning discharges were obtained using a computerized technique which allows a large amount of data to be analyzed quickly. Dissert. Abstr.

N80-29961 Tennessee Univ., Knoxville.
ATMOSPHERIC TURBULENCE SIMULATION TECHNIQUES WITH APPLICATION TO FLIGHT Ph.D. Thesis
Show-Tien Wang 1980 173 p
Avail: Univ. Microfilms Order No. 8018503

Statistical modeling of atmospheric turbulence is discussed. The statistical properties of atmospheric turbulence, in particular the probability distribution, the spectra, and the coherence are reviewed. Different atmospheric turbulence simulation models are investigated and appropriate statistical analyses are carried out to verify their validity. The models for simulation are incorporated into a computer model of aircraft flight dynamics. Statistical results of computer simulated landings for an aircraft having characteristics of a DC-8 are reported for the different turbulence simulation techniques. The significance of various degrees of sophistication in the turbulence simulation techniques on the landing performance of the aircraft is discussed. Dissert. Abstr.

N80-29962* Indian Meteorological Dept., New Delhi.
THE MONSOON EXPERIMENT MONEX
P. K. Das Bangalore, India Indian Space Research Organ.

Sep. 1979 12 p
(ISRO-SN-08-79) Avail: NTIS HC A02/MF A01

A subprogram of the Global Atmospheric Research Program, the monsoon experiment popularly known as MONEX was designed to study the contribution of the monsoons in different parts of the world to the Earth's atmosphere. Data were collected by ships and/or aircraft from India, the U.S.S.R., the United States, and France as well as by GOES and METEOSAT satellites and balloon-borne sondes. Of particular interest was the radiation balance of the Earth-atmosphere system. The results which are expected to become available when all the data are analyzed and studied are outlined as well as the implications for India.
A.R.H.

N80-29963*# New York Univ., N. Y.
MOUNTAIN WINDS (REVISITED)
Eugene Isaacson and Gideon Zwas [1980] 30 p refs
(Grant NsG-5034)
(NASA-CR-163406) Avail: NTIS HC A03/MF A01 CSCL 04B

The prediction of extremely high wind speeds, at ground level on the downstream side of a mountain range, is possible by solving the initial value problem for a two-layered nonlinear shallow water model of the atmosphere. Three different numerical methods are described to find the solutions which may involve shocks: (1) the vonNeumann-Richtmyer artificial viscosity method, (2) a filtering scheme, and (3) a hybrid method. Author

N80-29964*# Texas A&M Univ., College Station. Dept. of Meteorology.
A PRELIMINARY ASSESSMENT OF THE ACCURACY OF SELECTED METEOROLOGICAL PARAMETERS DETERMINED FROM NIMBUS 6 SATELLITE PROFILE DATA Final Report
James R. Scoggins and Gray Petti Washington, D.C. Aug. 1980 43 p refs
(Contract NAS8-31773)
(NASA-CR-3308) Avail: NTIS HC A03/MF A01 CSCL 04B

Published rms errors in rawinsonde data and discrepancies between satellite and rawinsonde profile data for temperature, dewpoint temperature, mixing ratio, and wind speed. Satellite rms errors were found to be 2 to 3 times as large as those for rawinsonde data. Gradients of the preceding parameters were computed for both rawinsonde and satellite data and compared with means and near extreme values computed from the AVE 2 and AVE 4 experiments. In all cases, it was found that satellite data can be used to determine with relatively good accuracy the near extreme gradients but not those whose value does not exceed the average. Synoptic charts were prepared to show that patterns of temperature could be determined with relatively good accuracy, while those of dew point were not as good as those for temperature. Winds represented by cloud motion vectors (satellite winds) were compared with rawinsonde winds, and it was found that large gaps exist in satellite values for a given pressure level and that errors in the satellite determined concluded that satellite profile data are very useful in synoptic analysis, particularly in data sparse regions as well as regions where near extreme gradients exist in the measured parameters. R.K.G.

N80-29965*# University of Central Florida, Orlando. Dept. of Mathematics and Statistics.
CLOUD COVER MODELS DERIVED FROM SATELLITE RADIATION MEASUREMENTS Final Report
Steven J. Bean and Paul N. Somerville 14 Nov. 1979 38 p refs
(Contract NAS8-33071)
(NASA-CR-161490) Avail: NTIS HC A03/MF A01 CSCL 04B

Using daily measurement of day and night infrared and incoming and absorbed solar radiation obtained from a TIROS satellite over a period of approximately 45 months, and integrated over 2.5 degree latitude-longitude grids, the proportion of cloud cover over each grid each day was derived for the entire period. For each of four three-month periods, estimates a and b of the two parameters of the best-fit beta distribution were obtained for each grid location. The (a,b) plane was divided into a number of regions. All the geographical locations whose (a,b) estimates were in the same region in the (a,b) plane were said to have the same cloud cover type for that season. For each season, the world was thus divided into separate cloud cover types. Using estimates of mean cloud cover for each season, the world was again divided into separate cloud cover types. The process was repeated for standard deviations. Thus for each season, three separate cloud cover models were obtained using the criteria of shape of frequency distribution, mean cloud cover, and variability of cloud cover. The cloud cover statistics were derived from once-a-day, near-local-noon satellite radiation measurements.
Author

N80-29966# Naval Oceanography Command Center/Joint Typhoon Warning Center, Guam.
TROPICAL CYCLONE MINIMUM SEA LEVEL PRESSURE; MAXIMUM SUSTAINED WIND RELATIONSHIP
Olaf M. Lubeck and John D. Shewchuk Apr. 1980 16 p refs
(AD-A085330; NAVOCEANCOMC/JTWG-TN-880-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

This paper investigates empirical relationships between maximum sustained surface winds and minimum sea-level pressure in western North Pacific tropical cyclones. The empirical equation developed by Atkinson and Holliday (1977) is reviewed and evaluated using 13 independent cases collected since the original study. New relationships were developed using the original dependent data set in Atkinson and Holliday and were tested also against the 13 independent cases. These new relationships were based on different assumptions for reducing observed peak wind gusts to one-minute sustained surface winds. There were no significant differences between the original Atkinson and Holliday relationship and the new relationships. Introducing environmental pressure and latitude as additional predictors did not improve the pressure-wind relationship. GRA

N80-29967# Air Weather Service, Scott AFB, Ill.
FORECASTERS GUIDE ON AIRCRAFT ICING
Mar. 1980 60 p refs
(AD-A085490; AWS-TR-80-001; AWS-Manual-105-39) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report presents information on aircraft icing that forecasters can use in forecasting and briefing for aircraft operations. It covers the atmospheric conditions that are favorable for aircraft icing and also how different aircraft types affect the potential for icing. GRA

N80-29968# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Air Weather Service.
CLOUD COVER AND VISIBILITY CLIMATOLOGY FOR THE PHILLIPINES Final Report
Daniel E. Mitchell May 1980 14 p Sponsored in part by Defense Mapping Agency
(AD-A085525; USAFETAC/PR-80/001) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report provides cloud cover and visibility climatology for 19 locations in the Philippines. The mean number of days with total cloud amount less than or equal to one-tenth and visibility greater than or equal to 6 miles for each month and by hours of the day are provided for each location. GRA

N80-29969# Geo-Atmospherics Corp., Lincoln, Mass.
CLOUD/ICING/VISIBILITY ANALYSIS SYSTEM (CIVAS) AND FORECAST DEVELOPMENT PLAN
Wayne D. Mount, B. Richard Fow, and Bruce D. Mount Apr. 1980 74 p refs
(Contract DAAD07-79-C-0089; DA Proj. 1L1-62111-AH-71) (AD-A085530; ERADCOM/ASL-CR-80-0089-123) Avail: NTIS HC A04/MF A01 CSCL 04/2

Geo-Atmospherics Corporation previously developed atmospheric models, meteorological data interpretation techniques, and computer software to provide a Cloud/Fog/Analysis System (CFAS) and Cloud/Fog Application Routines (CFAR). The CFAS assimilates the four-dimensional distribution of weather information by taking into account type, age, and location of meteorological observations to perform an objective analysis to specify each weather variable on a moveable three-dimensional array of grid points. This data base generated by CFAS can be used individually or its parts analyzed to tailor operational products to a given application. Our CFAR was developed to interrogate the CFAS data base, extract, analyze, and display a map of each chosen

parameter, i.e., sky cover, ceiling, visibility, precipitation, severe weather, cloud base, cloud top, and cloud amounts within nine different layers extending from the surface to 3000 meter altitude, the highest level of interest to Army aviation. These techniques have been expanded to develop a Cloud/Icing/Visibility Analysis System (CIVAS) to deduce the three-dimensional distribution of clouds, aircraft icing threat, and visibility, on a horizontal grid scale of 5 km. GRA

N80-29970# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

ESTIMATION OF LATERAL AND ROTATIONAL CLOUD DISPLACEMENT FROM SATELLITE PICTURES

Uwe L. Haass and Thomas A. Brubaker Hanscom AFB, Mass. AFGL Oct. 1979 18 p refs Presented at the Workshop on Computer Analysis of Time-Varying Imagery, Philadelphia, 5-6 Apr. 1979

(Contract F19628-78-C-0207; Grant DAAG29-76-G-0324; AF Proj. 6670)

(AD-A085810; AFGL-TR-79-0287; SR-1) Avail: NTIS HC A02/MF A01 CSCL 04/2

Weather forecasting in the mesoscale range often remains problematic due to the rapid changes. With the advance of high-resolution imaging techniques, satellite pictures taken in short time intervals can be employed to improve interpretation and prediction of atmospheric situations by analyzing cloud motion and size parameters. Knowledge of these parameters allows estimation of wind fields as well as the establishment of time series in order to model the cloud development and extrapolate from past observations. Our objective is to find estimators that reveal not only information on lateral (x-y) displacement, but also on rotation of clouds. These estimators should perform well for a variety of meteorological conditions. Currently, a variety of cloud displacement estimators are competing for computational convenience and versatility in application (1-6). Our work concentrates on methods applying the Inner Product (popularly called cross-correlation) since we hope to combine a mathematically elegant theory with efficient strategies for application. GRA

N80-29971# Arizona Univ., Tucson.

MULTIWAVELENGTH LIDAR STUDY OF FOG

B. M. Herman and R. M. Schotland May 1980 36 p refs

(Contract DAAG29-76-D-0100; DA Proj. 1L2-62111-AH-71)

(AD-A086143; ERADCOM/ASL-CR-80-0100-1) Avail: NTIS HC A03/MF A01 CSCL 04/2

A study has been conducted to define quantitatively the range and accuracy of multispectral lidar techniques for remotely sensing the visibility and liquid water content of various types of fogs. The results indicate that the penetration of the lidar pulse into the fog is limited to a few hundred meters due to the severe attenuation of the pulse by the fog. Methods to obtain extinction, backscatter and total liquid water content are also discussed. GRA

N80-29972# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

SOUNDING ROCKET PROGRAM IN AERONOMY: METEOROLOGICAL EVALUATION OF THE WINTER ANOMALY; CAMPAIGN IN SPAIN DURING 1975/76 Final Report

Barbara Naujokat, Karin Petzoldt, Juergen Knittel, Karin Labitzke, and Ernst Klinker Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-13) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 17.25

It is assumed that one of the causes of the winter anomaly in ionospheric absorption is found in the conditions associated with transport and temperature. Therefore, the circulation in the stratosphere and mesosphere at a height of from 20 to 80 km was examined during the Western European winter anomaly campaign of 1975/76. Results show that the development of planetary waves in space and time, the related horizontal and vertical motions, and their effect on the temperature of the mesopause region have to be considered in order to understand the absorption behavior at a particular location. Author (ESA)

N80-29973# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.

DESCRIPTION OF SOME PROPERTIES OF THE HUMIDITY ANALYSIS SCHEME IN USE AT THE EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS

Jan vanMaanen 1979 33 p refs Sponsored by European Centre for Medium Range Weather Forecasts

(KNMI-V-334) Avail: NTIS HC A03/MF A01

The objective humidity analysis used in a medium range numerical weather forecasting computer program was investigated. The accuracy of this scheme and its validity for a numerical forecast was evaluated in two independent ways. First, the weighting function used in the correction method was modified and the results analyzed. Second, the influence of varying the initial moisture field parameter on the forecast was studied. Results indicate that the absolute quality of variations of the weighting function cannot be estimated because of fundamental uncertainty in the true atmospheric state. Regarding specification of initial humidity, it is confirmed essential to numerical forecasting, especially in connection with predictions of rainfall intensity and cloudiness. Author (ESA)

N80-29974# National Weather Service, Silver Spring, Md. Office of Hydrology.

A METHODOLOGY FOR POINT-TO-AREA RAINFALL FREQUENCY RATIOS

Vance A. Myers and Raymond M. Zehr Feb. 1980 182 p refs

(PB80-180102; NOAA-TR-NWS-24; NOAA-80032111) Avail: NTIS HC A09/MF A01 CSCL 04B

A procedure is developed for calculating geographically fixed depth-area ratios from dense networks of recording precipitation gages. These ratios are needed to reduce published point precipitation frequencies to areal values. GRA

N80-29975# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.

SUMMARY OF GREAT LAKES WEATHER AND ICE CONDITIONS, WINTER 1977 - 1978

R. A. Assel, D. E. Boyce, J. Wartha, and F. E. Keyes Dec. 1979 137 p refs

(PB80-179203; NOAA-TM-ERL-GLERL-26; NOAA-80032001) Avail: NTIS HC A07/MF A01 CSCL 04B

The winter of 1977-78 was the 12th coldest since 1850. The north westerly flow aloft during this winter directed anticyclonic centers to the west and south of the Great Lakes Region, bringing the greatest negative air temperature departure from normal ever recorded on the southern lakes. Ice began forming in the shallows of the Great Lakes in late November. Lake St. Clair was virtually frozen over by early January. The remainder of the Great Lakes neared maximum areal ice extent from mid-February to early March; Lake Superior was 82% covered, Lake Michigan 52%, Lake Huron 89%, Lake Erie 100%, and Lake Ontario 57%. Spring breakup began in mid-March. The bulk of the ice was gone by April 26, but ice was observed as late as May 11 in eastern Lake Erie. GRA

N80-29976# Eddy (Amos), Inc., Norman, Okla.

AN INVESTIGATION OF SATELLITE-RADAR CORRELATION FUNCTIONS Final Report, 1 Feb. 1979 - 29 Feb. 1980

Louis A. Hembree Mar. 1980 213 p refs

(Contract DI-9-07-85-V0024)

(PB80-176001) Avail: NTIS HC A10/MF A01 CSCL 04B

The problems of combining the radar and satellite data sets through the use of space time correlation fields are addressed. These correlation fields represent the storm structure as implied by the observed data. The correlation fields are modeled using a four dimensional Gaussian damped cosine function whose parameters reflect the storm characteristics. Several Montana convective storm complexes have been studied to determine the correlation fields which are required for the application of optimum interpolation objective analysis and for the classification of the storms. It is shown that suitable correlation fields can be obtained with respect to the autocorrelation fields; however, a more general correlation model may be required for the cross-correlation fields. GRA

N80-29977# Alaska Univ., Fairbanks. Inst. of Marine Science.
RECENT FLUCTUATIONS IN METEOROLOGICAL AND OCEANOGRAPHIC PARAMETERS IN ALASKA WATERS
H. J. Niebauer Feb. 1980 40 p refs
(Grants NOAA-04-8-M01-187; NSF DPP-76-23340)
(PB80-186406; ASGR-79-12; IMS-79-2; NOAA-80042203)
Avail: NTIS HC A03/MF A01 CSCL 04B

In the last few years, especially since 1970, there were extraordinary variations in the shortterm climate over the North Pacific that are hypothesized to cause variations in oceanographic conditions such as sea temperature and ice coverage in Alaskan waters. Some of the relatively large-surface and 700 mb (3000 m) winds and ice coverage and their interrelationships are outlined. The study areas are the shelf regions of the Gulf of Alaska from Sitka to Kodiak and the southeastern Bering Sea. The time span considered is approximotaly the early 1960s to the present. GRA

N80-29978# National Weather Service, Silver Spring, Md. Office of Technical Services, Communications Div.
NOAA/NWS CATALOGUE OF METEOROLOGICAL BULLETINS
Jan. 1980 241 p
(PB80-183684; NOAA-80042405) Avail: NTIS HC A11/MF A01 CSCL 04B

Communications Handbook No. 6, the NOAA/NWS Catalog of Meteorological Bulletins, is a three section references manual. Section 1 contains all meteorological bulletins originated at KWBC, sorted by bulletin heading. Section 2 contains foreign meteorological bulletins which are distributed domestically. Section 3 contains aviation oriented meteorological bulletins which are available from the FAA Request-Reply System. A description of the bulletins, the approximate time of transmission, generation, observation or valid time and the code used is listed for each entry. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-29979 Washington Univ., Seattle.
INITIAL-VALUE PROBLEMS IN STRATIFIED SHEAR FLOWS Ph.D. Thesis
Jerre Eugene Bradt 1979 145 p
Avail: Univ. Microfilms Order No. 8013498

The stability of steady state solutions in geophysical fluid flows is addressed through qualitative analysis and quantitative examples. The inviscid linear stability theory of stratified shear flows and the solution of the stability problem using normal modes and Fourier Laplace transforms are discussed. Two numerical examples are used to illustrate the relationship of various physical parameters to the stability of the system and to trace the development of the instability for short, intermediate, and long times. The examples are (1) a two layer fluid of infinite extent with application to the air-sea interface and (2) a two layer fluid having a free surface and finite depth with application to a salt wedge estuary. The initial value problem is solved using a power series expansion for short times, superposition of modes for intermediate times, and asymptotic analysis for long times. The asymptotic expansion applicable in nonconservative systems is compared with the approximate solution using ray techniques, which are valid in conservative systems, and analytic continuation of the eigenvalues into the complex wavenumber plane. Dissert. Abstr.

N80-29980# Naval Research Lab., Washington, D. C. Radar Techniques Branch.
OBSERVATION BY HF RADAR OF THE PHILLIPS RESONANCE MECHANISM FOR GENERATION OF WIND WAVES Interim Report
D. B. Trizna, R. W. Bogle, J. C. Moore, and C. M. Howe 14 Mar. 1980 40 p refs
(RR0210141)
(AD-A085473; AD-E000426; NRL-8386) Avail: NTIS HC A03/MF A01 CSCL 08/3

Measurements are reported of directional ocean wave spectra made over 80 deg of viewing angle by an HF radar, operating in the surface wave mode in an area 22.5 km north of San Clemente Island, California. Ten azimuths from 280 to 360 deg true bearing were simultaneously measured for ten wave frequencies ranging from 0.14 Hz (75-m waves) to 0.35 Hz (13-m waves). A Waverider buoy was used to measure omnidirectional energy in the region, and first-order radar Bragg lines were used to determine the spreading of wave energy with angle. Data are presented in which a bimodal spectrum was present: an attenuated spectrum with wave components to 0.10 Hz from a storm at sea at 270 deg bearing; and a transient local wind spectrum, stronger in amplitude at the higher frequencies, with wave cutoff near 0.14 Hz, and running from 315 deg bearing. Just after the onset of local winds, the westerly spectrum fit a cosine squared spread at the lowest measured frequencies. With the development of local wind which blew at a 12 to 14 knot speed for a period of 12 h, the wave spectrum spread about the wind direction as cosine thirty second at the lowest frequencies measured, 0.14 Hz, and cosine sixty-fourth at the highest frequencies measured, 0.35 Hz. For 0.28 Hz waves, the Phillips resonance mechanism for wave generation is proposed to explain the twin peaks in amplitude observed, equally spaced either side of the wind direction. These were dominant for the earliest measurement period, and still major contributions for later measurement periods. GRA

N80-29981# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
DEVELOPMENT OF CONSISTENT NATURAL ENVIRONMENT PARAMETER SETS FOR COMBATANT CAPACITY ASSESSMENT (CCA) Final Report
Wah T. Lee and Susan L. Bales Mar. 1980 47 p refs
(AD-A085571; DTNSRDC/SPD-0795-02) Avail: NTIS HC A03/MF A01 CSCL 04/2

In order to design and model some combat systems, it may be necessary to consider joint distributions of two or more natural environment parameters. This can be accomplished by simultaneous sampling of various natural environment parameters. A major part of the investigation reported herein is the development of wind generated significant wave height as a function of latitude for the Northern Hemisphere, however, a joint sampling of other surface and atmospheric parameters is also included. GRA

N80-29982# Washington Univ., Seattle. Dept. of Oceanography.
A SEASONAL AND SPATIAL SUMMARY OF OCEANOGRAPHIC DATA FROM THE NORTHEASTERN TROPICAL PACIFIC (DOMES REGION), SUMMER 1975 AND WINTER 1976
M. D. Ohman, E. Orturgut, and R. J. Ozretich Sep. 1979 125 p refs
(Contract NOAA-03-6-022-35101)
(PB80-184484; REF-M79-53; SR-91; NOAA-80042301) Avail: NTIS HC A06/MF A01 CSCL 08J

Upper water column data are presented from two series of cruises to the northeastern tropical Pacific conducted as part of the DOMES (Deep Ocean Mining Environmental Study) project. The data selected include hydrographic data, dissolved chemical constituents, biochemical parameters, phytoplankton pigments and primary production rates, and suspended particulate concentrations. Tabular summaries and histograms of data values are presented for four depth zones: the surface mixed layer, the pycnocline, bottom of the pycnocline to 4000 m, and 4000-1000 m. Statistically detectable spatial heterogeneity exists across the DOMES region, although the variables which best indicate this heterogeneity are different above and below the pycnocline. To a lesser extent, seasonal differences are also detected. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-29983 Louisiana State Univ., New Orleans.
BLOOD FLOW TO ADIPOSE TISSUES IN THE MALE

SPRAGUE-DAWLEY RAT Ph.D. Thesis
Barbara Jean Maren 1980 214 p
Avail: Univ. Microfilms Order No. 8018275

The differences in adipocyte size among adipose depots in the male Sprague Dawley rat were studied with respect to their effect on blood flow. Blood flow was also examined within adipose depots to detect how it might vary with an increase of both adipocyte size and animal body size (age). In addition, since adipose tissue serves different metabolic functions of the body during the fed and fasted states, the effect of nutritional status on adipose tissue blood flow was studied. Results are presented. Dissert. Abstr.

N80-29984 New York Univ., N. Y.
VESTIBULAR COMPENSATION IN THE RAT: A MODEL FOR MOTOR LEARNING Ph.D. Thesis
Kerry Dee Walton 1980 290 p
Avail: Univ. Microfilms Order No. 8017600

A global picture of the changes in neuronal activity underlying the acquisition and retention of vestibular compensation (VC). Brain stem and cerebellar nuclear levels was obtained using 2-deoxy-D-glucose. The distribution of glucose uptake at these sites was determined in normal, uncompensated, compensated, and 3-acetylpyridine decompensated animals. Results indicate that the asymmetries following hemilabyrinthectomy reflect an imbalance in the activity of the vestibular nuclei (VN) and that compensation results from the restoration of balance. In uncompensated and decompensated animals the VN ipsilateral to the lesion were significantly less active than the contralateral VN. In compensated animals, VN activity was the same on the both sides, the level being close to or higher than normal. Thus, VC is accompanied by an increase in activity in the ipsilateral VN. Author

N80-29985 California Univ., Davis.
EFFECT OF ACCELERATION ON CIRCULATORY AND RESPIRATORY FUNCTION IN THE DOMESTIC FOWL Ph.D. Thesis
Sue Carol Walgenbach 1979 123 p
Avail: Univ. Microfilms Order No. 8016790

The respiratory and circulatory function was examined in chickens exposed to high sustained G sub z (exposure to fields greater than 6 G for 15 seconds: HGS sub z) Acceleration tolerance was determined for cocks exposed to + 6, +8, +10, and +12 G sub z. Acceleration tolerance time was found to be hyperbolically related to the field strength (G). Blood gases in chickens during HSG sub z exposure showed that chickens, unlike mammals, had near normal PaO2 and PaCO2. Forced ventilation of centrifuging chickens with oxygen increased PaO, a response not found mammals. Ventilation of one lung with air produced near normal PaO2 and PaCO, at 1 G, but in HGS sub z gave low PaO, as observed in spontaneously breathing mammals. Ventilation did not extend all tolerance times suggesting circulatory impairments are principally responsible for acceleration tolerance limitations. Expired P(CO2) during oxygen ventilation indicated that cardiac output decreased during HSG sub z, even down to zero for several seconds; after HSG sub z, expired P(CO2) increased, indicating that oxygen debt and metabolism perfusion inequalities were developed during HSG sub z. Dissert. Abstr.

N80-29986 Kentucky Univ., Lexington.
THE NEURAL CONTROL OF THE CORONARY CIRCULATION DURING BEHAVIORAL STRESS IN CONSCIOUS DOGS Ph.D. Thesis
George Edward Billman 1980 161 p
Avail: Univ. Microfilms Order No. 8018226

Experiments were performed on eight (3 female, 5 male) mongrel dogs during classical aversive conditioning. The conditioning paradigm consisted of two 30 second tones; one was paired with a one second pulsed DC shock, the other was nonreinforced. The subjects were chronically instrumented to measure aortic pressure, left ventricular pressure, and left circumflex coronary blood flow. The data were analyzed with multifactorial analysis of variances and Newman's-Keul's multiple range test. Results indicate that the coronary vascular response to stress consisted of two components: an initial alpha adrenergic vasoconstriction followed by a more complex vasodilation, which was mediated by metabolites released secondarily to increases in heart rate and inotropic state. The vasodilation may also involve a reactive hyperemic response to the initial vasoconstriction or perhaps a reflex withdrawal of alpha receptor tonus. Dissert. Abstr.

N80-29987 Florida Technological Univ., Orlando.
A COMPARATIVE STUDY IN MOLECULAR AGING: ALTERATIONS TO THE NUCLEIC ACIDS OF CELLS OF A REPRESENTATIVE PLANT, INVERTEBRATE AND VERTEBRATE ANIMAL OF VARIOUS AGES Ph.D. Thesis
Charles David Allen Polson 1979 93 p
Avail: Univ. Microfilms Order No. 8016621

The DNA of three tissues of Mus musculus, wild type and short lived vestigial wing mutant of Drosophila melanogaster and cotyledons of bush beans, Phaseolus vulgaris, was examined for age related fragmentation, formation of single stranded gaps, and decrease in RNA genes. Agarose gel electrophoresis showed that no DNA fragmentation occurred in wild type or vestigial wing Drosophila, or in DNA from mouse brain and heart. Mouse liver appeared to possess a large fragment in both ages tested; thus, no age related change occurred. Phaseolus cotyledon DNA possessed a fragment of approximately 3.5 megadaltons in both imbibed seeds and 12 day old cotyledons. Therefore, there was no age related increase in DNA fragmentation. Results indicate that DNA fragmentation, formation of single-stranded gaps, and loss of RNA genes are not of universal occurrence in aging organisms. Dissert. Abstr.

N80-29988 American Univ., Washington, D. C.
INTERACTION OF ELECTROMAGNETIC ENERGY WITH ABSORPTIVE MATERIAL BY THERMALLY INDUCING ELASTIC STRESS WAVES Ph.D Thesis
Kenneth John Oscar 1980 225 p
Avail: Univ. Microfilms Order No. 8017445

Rats were exposed to 1.3 or 2.8 gHz, pulsed or continuous wave (CW) microwave energy. Exposure time, incident power, and microwave pulse characteristics were varied. Local cerebral blood flow, blood volume, and blood-brain barrier permeability experiments were performed with several different, quantitative, radioactive isotope techniques with measurement by brain homogenization and liquid scintillation counting. It was confirmed that low power microwaves could alter the uptake of small molecular weight saccharides in the blood-brain barrier of rats. It was further learned that the permeability increases occurred for small but not large molecular weight saccharides. The rises returned to normal after 24 hours and were of greatest magnitude in the medulla, cerebellum, and hypothalamus. The relationship between the magnitude of the increase and the pulse characteristics of the microwaves were determined. Other pertinent observation and results are reported. Dissert. Abstr.

N80-29989# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
BIOMEDICAL RESEARCH, DEVELOPMENT AND ENGINEERING AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Annual Report, 1 Oct. 1978 - 30 Sep. 1979
Oct. 1979 74 p refs
(PB80-175268: JHU/APL/MQR-79) Avail: NTIS HC A04/MF A01 CSCL 06B

The Medical Institutions of The Johns Hopkins University and The Johns Hopkins University and The Johns Hopkins University Applied Physics Laboratory have developed a vigorous collaborative program of biomedical research, development, and systems engineering. An important objective of the program is to apply the expertise in engineering, the physical sciences, and systems analysis acquired by APL in defense and space research and development to problems of medical research and health care delivery. This program has grown to include collaboration with many of the clinical and basic science departments of the medical divisions. Active collaborative projects exist in ophthalmology, neurosensory research and instrumentation development, cardiovascular systems, patient monitoring, therapeutic and rehabilitation systems, clinical information systems, and clinical engineering. This application of state-of-the-art technology has contributed to advances in many areas of basic medical research and in clinical diagnosis and therapy through improvement of instrumentation, techniques, and basic understanding. GRA

N80-29990# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
HIGH-SPEED, LOW-LEVEL FLIGHT: AIRCREW FACTORS
David H. Glaister, ed. (Royal Air Force Inst. of Aviation Medicine) Mar. 1980 321 p refs In ENGLISH and FRENCH Presented at the Aerospace Med. Panel's Meeting, Lisbon, 22-26 Oct. 1979
(AGARD-CP-2670; ISBN-92-835-0263-9) Avail: NTIS HC A14/MF A01

Factors effecting aircrews during high speed, low level flight are addressed. Specific topics include ride quality and the effect of the physical environment; thermal effects; vibration effects; cockpit design and aircrew workload; and escape and survival. Particular attention is paid to ride bumpiness and the influence of airframe design and control strategy, the effects of vibration on vision, and the problems and potential uses of helmet mounted sights and displays. For individual titles, see N80-29991 through N80-30018.

N80-29991# Royal Air Force, Farnborough (England).
RIDE-BUMPINESS AND THE INFLUENCE OF ACTIVE CONTROL SYSTEMS c54
J. G. Jones *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The influence of aircraft design and control strategy on aircraft disturbances stressful to aircrew in high-speed, low-altitude flight is discussed. Standard methods for assessing ride quality are briefly reviewed. In addition, a technique is described that combines time-plane characteristics of response with frequency-plane features usually defined in terms of power spectra. This method, which has been developed as a tool for assessing the dynamic response of aircraft in turbulence, may provide useful additional information for human factors work. The technique leads in particular to a 'characteristic signature', in the time plane, of the aircraft response to gusts. In determining the dependence on aircraft dynamics of this characteristic energy pattern emphasis is placed on the concept of signal 'increments' or 'differences', in contrast to the sinusoidal components of Fourier analysis. It is perhaps relevant that the role of signal differences in time or space is also stressed in classical work on the mechanisms of human sensory perception. M.G.

N80-29992# Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).
INFLUENCES OF GEOPHYSICAL FACTORS (METEOROLOGICAL AND TOPOGRAPHICAL) ON THE PILOT-AIRCRAFT-SYSTEM IN HIGH SPEED LOW LEVEL FLIGHT (HSLLF) c54
Karl Krames *In* AGARD High-Speed, Low-Level Flight Mar. 1980 46 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of interaction between atmosphere, lithosphere, and biosphere on low level high speed flight are discussed along with particular examinations of visibility, wind, thunderstorms, and sleet and hailstones. Since geophysical hazards are at their maximum in low levels, it follows that an extreme reaction ability of the man-machine system in that domain is an absolute requirement. The primary function of geophysical information consists in assessing those flight routes and flight levels presenting minimum potential hazards to the accomplishment of the individual military mission. The use of terrain data bases offers an optimal approach in achieving a high degree of resolution on the basis of 95-by-150-m-grid. The inclusion of weather, vegetation, and surface data will ensure detailed flight information. M.G.

N80-29993# British Aerospace Aircraft Group, Preston (England).
DEVELOPMENT IN HIGH-SPEED LOW-LEVEL FLIGHT: THE PILOT'S VIEWPOINT c54
J. J. Lee *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Developments in aviation technology during the last one and a half decades leading to significant benefits to high speed low level flight are briefly reviewed. It is concluded that the human characteristics of sensitiveness to stimuli, reaction time, strength/stamina, and adaptability have remained virtually unchanged in evolution terms and will remain a constant in flight assessment. Given the requirements of the mission and the scenario, the areas where development can be applied to improve mission success still remain firmly in the fields of performance, handling, guidance/navigation and vehicle design characteristics. M.G.

N80-29994# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BIOTECHNOLOGY CHALLENGES PRESENT IN OPERATIONAL HIGH-SPEED LOW-LEVEL FLIGHT c53
Roy L. DeHart *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Operational stressors in high speed low level flight (HSLL) are identified for the mission scenarios of the B-52, F-111, and the A-10 aircraft. It is concluded that there exists a common technology need requiring contributions from the aerospace medical practitioner which becomes evident in discussing the aircraft in their respective HSLL combat missions. Continued development of automated systems integrating components within the cockpit affecting aircraft controls and weapons delivery systems is required. The specialist in aerospace medicine must ensure that sophisticated systems do in fact offload peripheral tasks of the pilot and increase his performance and ability to successfully accomplish the mission in a high threat combat environment. In addition, it is evident opportunities are available for biotechnology to improve or develop systems providing required information to the aircrew member in a method or format which permits him to remain heads-up and eyes-out-of the cockpit. M.G.

N80-29995# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).
THERMIC PROBLEMS PRESENTED BY HIGH-SPEED, LOW-LEVEL FLIGHT [PROBLEMES THERMIQUES POSES PAR LE VOL A GRANDE VITESSE ET A BASSE ALTITUDE] c52
J. Timbal and J. Colin *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs In FRENCH (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

In certain cases, high speed flight at low altitude is likely to create conditions which surpass the tolerance limits of pilots. The physical factors of the environment as well as their effects on performance have been the subject of numerous studies. One method of predicting the period of heat tolerance is presented and discussed. The important part played by the humidity of the air and the physical activity of the pilot is demonstrated. The prevention of climatic inconveniences requires the use of relatively simple means which must be put into effect before flight. During the course of flight, prevention implies that the inconveniences were predicted during the design of the aircraft. The problem of risk associated with thermal loads is discussed under three principles: evaluating thermal ambience, evaluating human tolerance, and increasing the tolerance. Transl. by A.R.H.

N80-29996# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
EFFECTS ON PERFORMANCE OF THERMAL STRAIN ENCOUNTERED DURING HIGH-SPEED, LOW-LEVEL FLIGHT c52
T. M. Gibson, J. R. Allan, C. J. Lawson, and R. G. Green *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of thermal strain on pilot performance during high speed, low level flight are examined through flight simulator testing. Each subject carried out two replicate experiments in which he was first heated to a deep body temperature of 37.5 C, then alternately heated and cooled twice between deep body temperature limits of 37.9 and 38.5 C, and finally cooled to 37.5 C. Core temperatures and skin temperatures were monitored. The results demonstrate that differences in performance on the flight simulator can be produced by heating or cooling the skin at the same level of deep body temperature. These differences do not exist at deep body temperatures of 37.5 C, but at core temperatures between 37.9 and 38.5 C, performance

during heating is worse than during cooling. Above the critical core temperature (i.e., above 37.5 C), skin temperature is a more important determinant of performance than the absolute level of deep body temperature; it is, however, impossible to exclude possible effects on performance of direction and rate of change of both core and skin temperatures. It is clear that the thermal strain encountered by aircrew in routine high speed, low level flight in warm conditions could cause a reduction in the operational capability of the aircrew. The situation will be exacerbated by anything that increases the thermal strain such as the wearing of more insulative protective clothing, higher work rates and repeated sorties separated by inadequate time for thermal recovery. M.G.

N80-29997# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.

AIRCREW HEAT STRESS DURING HIGH-SPEED, LOW-LEVEL FLIGHT **c52**

Richard F. Stribley and Sarah A. Nunneley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

An overview of the problems related to aircrew heat stress during high speed low level flight is given. Physiological heat exchange mechanisms in the cockpit environment and the performance consequences of heat stress are examined. Current cockpit cooling systems designs are assessed and suggestions are made for the design of man-oriented cockpit cooling. M.G.

N80-29998# Laboratoire Central de Biologie Aerospatiale, Paris (France).

QUANTIFYING THE AGRESSION GENERATED BY LOW FREQUENCY VIBRATIONS [ESSAI DE QUANTIFICATION DE L'AGRESSION ENGENDREE PAR LES VIBRATIONS DE BASSE FREQUENCE] **c54**

P. Quandieu, P. Borredon, J. C. Rouhet, and L. Pellieux *In* AGARD High-Speed, Low-Level Flight Mar. 1980 17 p refs In FRENCH (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

From a biomechanical viewpoint, man can be considered as a deformable solid under the effect of mechanical stimulation such that as provoked by flight at high speed and low altitude. A physiological response to physical stimulation results and muscular mass struggles against the deformation imposed. According to the degree of muscle tension, the vibratory response of the subject is a phase displacement in relation to the oscillation which gives birth to movement. The final deformation is the result of mechanical action and physiological reaction. A baboon was used in laboratory tests to demonstrate magnitude of the mechanical capability to account for the behavior of a subject exposed to vibrations. A loads transducer and an accelerometer were placed at the point where force was applied in order to determine the effective mass (the complex relation of dynamic force to the acceleration). With the help of measurements obtained totally outside the body, it was possible to record an eminently variable dynamic behavior the whole length of the same vibration. The importance of the variations obtained on the parameters considered provides hope for using the method to examine the total behavior of man exposed to vibrations. Transl. by A.R.H.

N80-29999# Naval Aerospace Medical Research Lab., New Orleans, La.

A METHOD FOR STUDYING HUMAN BIODYNAMIC RESPONSES TO WHOLE-BODY Z-AXIS **c52**

J. C. Guignard, C. L. Ewing, G. C. Willems, W. Anderson, W. H. Muzzy, III, D. J. Thomas, and P. L. Majewski *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

The methodology used as well as some illustrative results obtained in current experiments to determine the transmissibility of mechanical vibration to major axial segments (pelvis, upper torso, head) of the seated human body vibrated in the z-axis are presented. Factors influencing transmissibility are mentioned and the importance of controlling such factors in experimental determinations of the human biodynamic response to vibration is discussed. The methodology described, adapted from established use in human impact studies, includes the use of standardized anatomical coordinate systems for data reference, which is essential to the meaningful comparison of responses measured in different subjects or in different conditions of vibration. R.C.T.

N80-30000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fer Flugmedizin.

HEAD MOVEMENTS INDUCED BY VERTICAL VIBRATIONS **c52**

L. Vogt, E. Schwartz, and H. Mertens *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

Eleven subjects were vibrated on a shake-table in the frequency range of 2 Hz to 19 Hz to assess the complex head motion induced by z-axis mechanical vibration. Acceleration amplitude was sinusoidal and held constant at 0.35 g (rms). Each subject was given two trials; one sitting relaxed without a backrest; the other leaning against a backrest with a 12 deg inclination from the vertical. Head motion was recorded with a special television camera (x-y tracker) by pursuing a target painted on the temporal part of the subject's forehead. This instrument continuously records the horizontal and vertical coordinates of the tracked point and gives the output as analogues voltages. For each frequency and experimental condition the vertical and horizontal motion of the tracking target was related to the displacement of the shake-table. The results are given as different transmissibility curves for vertical and horizontal head motion. When relating horizontal to vertical transmissibility it becomes obvious that, without a backrest, at the resonant frequency the horizontal transmissibility is about 75 percent of the vertical transmissibility. When using a backrest horizontal transmissibility is reduced to about 35 percent of the vertical transmissibility. R.C.T.

N80-30001# Royal Aircraft Establishment, Farnborough (England).

THE EFFECT OF RECLINED SEATING ON THE TRANSMISSION OF LINEAR VIBRATION TO THE HEAD **c54**

Mary E. Johnston *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

The transmission of vibration to the heads of subjects seated in a Mk 10B ejection seat exposed to vibration within the frequency range 2-25 Hz was measured. Measurements were made for the seat conventionally mounted (back angle 20 deg to the vertical) and reclined for seat back angles of 30 deg., 45 deg., and 60 deg. to the vertical. The seat was vibrated using a swept sine wave technique in either the vertical or lateral direction. Head motion in each of the three head anatomical orthogonal linear axes (G sub x, G ub y, G sub z) was measured on a bite bar fitted with accelerometers. Ten subjects were used, each fitted with a standard Mk 2/3 flying helmet. The results indicate that for a given input, particularly in the lateral axis, head motion increases considerably when the head is in contact with the rest. Also head motion both against and off the rest increases as the seat back angle to the vertical is increased. Such increases in vibration to the head are very uncomfortable and could well lead to a performance decrement for a visual task. R.C.T.

N80-30002# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

THE EFFECTS OF AIRCRAFT VIBRATION ON VISION **c54**

G. R. Barnes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

Movements of the head resulting from aircraft vibration were investigated in terms of their effects on visual performance. Major emphasis was placed on the limitations in the response of the pursuit reflex and the vestibulo-ocular reflex. The following analyses were conducted in order to assess: (1) the frequency characteristics of the vestibulo-ocular and pursuit reflexes; (2) the ability of subjects to suppress reflex vestibular eye movements which become inappropriate when viewing a helmet-mounted display; (3) the effect of relative movement between the eye and the viewed object on visual performance,

and (4) the biodynamic response of the head during vibration which gives rise to stimulation of the vestibular system. The results are discussed in an attempt to estimate the effects of aircraft vibration on visual performance. R.C.T.

N80-30003# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF 3-25 Hz VIBRATION ON THE LEGIBILITY OF NUMERIC LIGHT EMITTING DIODE DISPLAYS c54
Mary E. Johnston and John H. Wharf *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of 3-25 Hz2 sinusoidal vibration at an rms acceleration level of 2.5 m/s2 in both the vertical and lateral axes on the performance of a reading task are described. The task was to read aloud numeric characters presented on a yellow high luminance light emitting diode display which was designed for the military cockpit. Random numbers were presented on the display in sets of four changed every 3 s. The subjects were each fitted with a MK 2/3 flying helmet and strapped into an Mk 10B ejection seat which was mounted on the same vibration platform as the display. Tests were conducted with the subject's head held both against and just off the head rest. The results indicate that reading performance is affected most by lateral vibration, when the head is against the head rest. Maximum errors occurred for lateral vibration frequencies of 15-16 Hz which is shown to correspond to the probable onset of overlapping nodal images due to head vibration. R.C.T.

N80-30004# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
THE EFFECT OF TURBULENCE ON HELMET MOUNTED SIGHT AIMING ACCURACIES c53
N. O. Tatham *In* AGARD High-Speed, Low-Level Flight Mar. 1980 4 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The effects of the turbulence associated with high speed, low level flight on the accuracies achievable with helmet mounted sighting equipment were assessed. In-flight analysis were conducted during trials in a Canberra aircraft, flying straight and level at 350 km, 250 ft. Laboratory analysis were conducted using a two axis vibration rig driven by vibration data recorded from the same Canberra aircraft to provide simulated turbulence. Aiming accuracies were obtained for collimated targets fixed in space in the simulation, and for both collimated targets fixed to the airframe and ground targets in flight. The results obtained show a good correlation between aiming errors achieved in flight and those obtained from the simulation, and demonstrate that the aiming errors consist mainly of a low frequency random motion which increases with vibration level. In addition, various techniques were investigated to overcome the errors involved in order to enable fine aiming to be performed with the helmet sight. R.C.T.

N80-30005# Naval Aerospace Medical Research Lab., New Orleans, La.
CLINICAL MEDICAL EFFECTS OF HEAD AND NECK RESPONSE DURING BIODYNAMIC STRESS EXPERIMENTS c52
D. J. Thomas, C. L. Ewing, P. L. Majewski, and N. S. Gilbert *In* AGARD High-Speed, Low-Level Flight Mar. 1980 15 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Volunteers were subjected to various degrees of impact acceleration. The directions of applied acceleration were -X (front to back), +Y (right to left), and -X+Y (45 degrees between -X and +Y). The major categories of symptoms were neck pain, headache, restraint related musculoskeletal symptoms, and syncope. A few special cases had findings which required clinical evaluation and followup. The type, extent, duration, and severity of the symptoms were related in some cases to the direction peak acceleration, and acceleration duration. R.C.T.

N80-30006# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATIONAL ASPECTS OF GUIDANCE AND CONTROL ADVANCES VERSUS PILOT WORKLOAD FOR LOW ALTITUDE, HIGH SPEED FLIGHT c54
Morris A. Ostgaard *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Some of the characteristics of the human operator and their similarity to guidance and control functions are discussed. It is shown that the operator's characteristics as a controller depend on four kinds of variables: control task variables, which include the system inputs and all the system elements external to the operator; environmental variables such as ambient illumination, temperature, vibration, etc.; operator centered variables such as training, fatigue, motivation; and procedural variables such as instructions, practice, order of presentation relating to a given task. When these variables are essentially time stationary or invariant over an interval of interest, the operator vehicle system can be modeled as a quasilinear system much the same as standard servo loops. R.C.T.

N80-30007# Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe (West Germany).
TV OPERATOR PERFORMANCE IN REAL TIME AIR-TO-GROUND RECONNAISSANCE MISSIONS UNDER TASK-LOADING CONDITIONS c53
H. Mutschler *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs Sponsored by the German Federal Ministry of Defense (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The detection performance of a black-and-white-TV operator in real time reconnaissance missions was determined by the parameters of the RPV-system, the scene, and the task. A series of 6 experiments were performed with 19 untrained subjects who had to find military vehicles in static ground scenes displayed on a TV screen. The scenes were presented only shortly, for 1 to 10 secs. This corresponds to a speed of about 50 to 500 km/h at a nonoverlapping frame rate. The subjects pointed to located targets with a light-pen. Analysis of variance indicate that the detection rate is influenced by: (1) scene parameters which consititute the conspicuity of a target in a natural scene, such as global context, contrast and local context; (2) short presentation times of less than 3 secs; (3) system parameters such as resolution and image segmentation; and (4) number of targets. Detection rate decreases if the task is to mark all targets and detection rate increases if the task is only to indicate those scenes which contain at least one target. The false alarm rate decreases with the number of sessions the subjects took part in and was finally at low level. Taking the confidence level expressed into account proved to increase the detection-false alarm ratio remarkably. Search times were nearly equal to presentation times from 1 to 5 secs only. The search times for the 50% detection rate decreased from 4 secs in the first experiment to 2 secs in the last one. R.C.T.

N80-30008# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
THE INFLUENCE OF THE DESIGN OF DISPLAYS ON COCKPIT WORKLOAD c54
R. H. Holmes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The problems involved in designing display and controls for high speed low level aircraft are discussed with the emphasis on the reduction of cockpit workload. Some modern display techniques are also described. R.C.T.

N80-30009# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
COLOUR DISPLAYS: THEIR AVAILABILITY, PERFORMANCE AND APPLICATION TO IMPROVED CREW EFFICIENCY c54
D. W. Hussey *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The use of advanced technology in the form of multifunction electronic displays, processors, sophisticated sensors, and other automated pilot aids are discussed. Guidelines are suggested which are to be used in determining how color is used to enhance the presentation of information. R.C.T.

N80-30010# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HELMET-MOUNTED DEVICES IN LOW-FLYING HIGH-SPEED AIRCRAFT c54
D. N. Jarrett *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Two separate simulation studies are described. The first assesses the amount of movement occurring between the pilot's helmet and his eyes. The second concerns the legibility of information presented on an experimental LED matrix display. It is concluded that aircraft vibration does not cause significant helmet movement in comparison with natural voluntary head motion, and that the degrading effect of aircraft vibration on the legibility of displayed information could be counteracted using a brighter display. E.D.K.

N80-30011# Naval Air Development Center, Warminster, Pa.
THE ROLE OF HELMET MOUNTED DISPLAYS IN HIGH-SPEED LOW-LEVEL FLIGHT c54
Gloria Twine Chisum *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

During critical phases of flight operations the requirement for shifts of gaze between the environment outside the cockpit and the interior of the cockpit is a problem which can be eased by the development of an effective helmet mounted display capable of presenting sensor and aircraft position and condition information. In both fixed wing and rotary wing aircraft, a head out of the cockpit attitude is considered to be highly desirable. An effective helmet mounted display is one which is comfortable to use, does not degrade normal visual functioning, can present the required information, and does not increase crew fatigue due to weight and bulk. The general design concerns regarding helmet mounted displays apply to those to be used in a high speed, low level environment. Some of the design parameters take on special significance, however, in high speed low level flight. E.D.K.

N80-30012# Naval Air Systems Command, Washington, D. C.
RESEARCH FOR VISUAL ENHANCEMENT FOR HIGH SPEED LOW LEVEL FLIGHT SPONSORED BY THE NAVAL AIR SYSTEMS COMMAND c52
H. Rosenwasser, Gloria Twine Chisum (NADC, Warminster, Pa.), J. J. Kulik (Naval Training Equipment Center), M. L. Wolbarsht (Duke Univ.), M. M. Cohen (NADC, Warminster, Pa.), and A. Lewis (Cornell Univ.) *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)
(Contracts N00019-78-C-0431; N00019-78-C-3036)
Avail: NTIS HC A14/MF A01

Apart from engineering considerations, the proper emphasis of the various parameters of visual displays in high speed low level flight depends upon the knowledge of the physiological variables in the visual system. Psychophysical tests can best be interpreted in conjunction with a detailed examination of the physiological function of the visual system. A summary of programs is given to show progress in this approach. E.D.K.

N80-30013# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
HUMAN FACTORS IN HIGH-SPEED LOW-LEVEL ACCIDENTS: A 15 YEAR REVIEW c03
R. C. Rud and D. F. Leben *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The Canadian Forces introduced the CF 104G into Squadron Operation in 1963 and since that time these aircraft have operated in the high speed, low level environment in both the strike/reconnaissance and tactical support roles. Fifty seven accidents involving these aircraft are reviewed with regard to cause factors. Marginal weather appears to be the one most significant factor contributing to low level, high speed accidents; however, several human factors such as visual contrast problems, fatigue, stress, reaction time, mission completion syndrome, inattention, and task overload were identified. Aspects of accidents which typify human factors problems are described. Suggested possible preventive measures are outlined. E.D.K.

N80-30014# Naval Aerospace Medical Research Lab., New Orleans, La.
CREW STATION ASSESSMENT USING THE BIOMAN MODELING SYSTEM c54
Georg D. Frisch, Louis A. Daulerio, and Michael Schultz *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs Prepared in cooperation with NADC, Warminster, Pa. (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The use of the Bioman modeling system in evaluating the physical compatability of crew members with crew stations under emergency egress conditions is demonstrated and the usefulness of this approach as both a design and evaluation criteria is illustrated. Validated results from F-18 aircraft investigations based both on ejection tower and human physiological acceptance tests are presented to demonstrate the evaluation process of a given crew station. Furthermore, these results are contrasted against those obtained from the A-4 and F-14 and the relative propensity of direct impact injuries are discussed. E.D.K.

N80-30015# Bureau of Medicine and Surgery (Navy), Washington, D. C.
NAVAL AVIATION WATER SURVIVAL PROGRAM c03
Wilton McIntosh *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The very nature of naval aviation requires that the majority of operation flights be conducted overwater. The missions vary from operations in the immediate vicinity of aircraft carriers and shore bases to single aircraft flights hundreds of miles form the nearest land. Each situation presents unique problems in terms of required survival equipment and length of time to rescue. Major revisions to the Naval Aviation Water Survival Program are presently underway. The Training curricula are being standardized and water survival instructors are to be extensively trained to conduct the training. Aviation life support systems are being modified to provide automatic life preserver inflation and parachute divestment. New water training devices are being procured and training is to be conducted in the devices with the same configuration of life support equipment with which the aircrew members fly. E.D.K.

N80-30016# Martin-Baker Aircraft Co. Ltd., Denham (England).
HIGH-SPEED, LOW-LEVEL FLIGHT SURVIVAL ON EJECTION c03
M. A. A. Hobbs *In* AGARD High-Speed, Low-Level Flight Mar. 1980 2 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The history of work on high speed low level ejection is presented. Current bay practices and a look into the future are also discussed. E.D.K.

N80-30017# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MINIMIZING THE SEQUENCED DELAY TIME FOR ESCAPE FROM HIGH-SPEED, LOW-LEVEL FLIGHT PROFILES c03
James H. Raddin, Jr., Lawrence J. Specker, and James W. Brinkley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

The time delay that occurs between the actuation of an escape system and the acual initiation of the ejection catapult acceleration separate the crew from an aircraft is one of the critical factors in the design of escape systems for high speed low level (HSLL) flight conditions. This delay may preclude what could otherwise be a successful escape from certain HSLL profiles. The purpose of this paper is to examine the significance of current operational delay times and describe techniques to minimize the delays. Operational through-the-canopy ejection data are presented to assess the risk of injury incurred in eliminating the delay time altogether. Experimental data from tests with human volunteers are presented to demonstrate the potential for significantly reducing the time required for upper torso retraction. Finally the implications of available aeromedical

evidence are elevated in the definition of the most promising approaches to minimize the time required for a HSLL escape sequence. E.D.K.

N80-30018# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
LOW LEVEL, ADVERSE ATTITUDE ESCAPE USING A VERTICAL SEEKING EJECTION SEAT c03
John J. Tyburski, Georg D. Frisch (Naval Aerospace Medical Research Lab., New Orleans, La.), and Louis A. Daulerio *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

Recent advances in the development of a maximum performance ejection seat (MPES) with a vertical seeking capability address the need for safe escape from aircraft at low altitude, high speed, and extreme adverse attitude conditions. The performance specifications of this system, as presently envisioned, provide safe egress from an inverted aircraft at airspeeds of 0 through 600 knots and altitudes as low as 50 feet above ground level (AGL). The data base and techniques to be used to predict the occupant response consist of instrumented ejection tests, mathematical simulations, and graphical analysis of tests results. Consideration is also given to the occupant's anthropomorphic properties and physical restrictions such as initial position and seat configuration. The applicability and efficacy of utilizing biodynamic response simulation and other techniques, not only as a design tool in the evaluation of the physical compatibility of man and ejection system, but also in the evaluation of the ejection system performance are demonstrated. E.D.K.

N80-30019# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
OPERATIONAL ROLES, AIRCREW SYSTEMS AND HUMAN FACTORS IN FUTURE HIGH PERFORMANCE AIRCRAFT
P. F. Iampietro, ed. Mar. 1980 97 p refs Partly in ENGLISH and FRENCH Presented at the Aerospace Med. Panels Specialist Meeting, Lisbon, 22-26 Oct. 1979
(AGARD-CP-266; ISBN-92-835-0262-0) Avail: NTIS HC A05/MF A01

The understanding of the operational characteristics of high performance aircraft in relationship to the operator's physiological, cognitive, psychomotor and perceptual capabilities is investigated. Relationships between man and machine are discussed in order to identify any biotechnology research deficiencies and establish appropriate selection, training, and assignment criteria for future high performance aircraft. For individual titles, see N80-30020 through N80-30028.

N80-30020# Department of the Air Force, Edwards AFB, Calif. F-16 Combined Test Force.
THE OPERATIONAL ROLES OF THE F-16 c05
Robert C. Ettinger *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 18 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The F-16 weapons system is described from its design features to its cockpit displays and controls. The multirole capacity of the F-16 is illustrated by description of the weapons delivery systems, aircraft performance, and weapons carriage capability. Typical operational missions from NATO bases in F-16 European participating countries over Central and Northern Europe are discussed in detail. E.D.K.

N80-30021# French Air Force, Paris. Bureau des Programmes de Materiel.
***OPERATIONAL MISSIONS AND CONCEPTUAL DESIGN OF THE MIRAGE 2000* c05**
Jacques Guillou *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 5 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The Mirage 2000 program was established to assure the replacement of all versions of the Mirage 2 aircraft. Intended for defense and aerial superiority, the first Mirage 2000 version must have the capability to intercept hostile bodies at very high altitude, to destroy hostile bodies penetrating at low altitude, and to engage in close combat with weapons equal to those on the best pursuit aircraft of its generation. The SNECMA M 53 engine will be used with a delta wing configuration and electric flight controls. The capacity for maneuverability of the Mirage 2000 marks a fundamental progress in relation to the preceeding aircraft and will lead to new combat techniques.
Transl. by A.R.H.

N80-30022# Royal Air Force, London (England).
THE CAPABILITIES AND OPERATIONAL ROLES OF ROYAL AIR FORCE TORNADOES c05
H. M. Archer *In* AGARD Operational Roles, Aircraft Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The concept of producing a multirole aircraft designed to meet the complexities of a number of roles was reached only after extensive computer analysis had shown the way ahead. For the RAF, the air-to-ground task and the air-to-air task calls for differing operating capabilities, but Tornado can meet these requirements. In its IDS version, the aircraft is able to effectively carry out the roles of counter-air, interdiction, close air support, maritime attack, and reconnaissance. Moreover, it is able to do so at very high speed and very low altitude, regardless of weather. The ADV on the other hand uses its powerful long range multitarget radar, advanced avionics with computerized mission planning, and automatic attack features, together with its missile armament, to make it the most effective interceptor available for the air defence of the UK's large strategic area. Backing this very wide range of capabilities, is a comprehensive maintenance system of support, designed from the outset to optimize fault diagnosis, and keep the aircraft ready to fly with the minimum delay. E.D.K.

N80-30023# French Air Force, Bretigny sur Orge. Centre d'Essais en Vol.
***WEAPONS SYSTEMS OF THE MIRAGE 2000: MAN MACHINE INTERFACE* [LE SYSTEME D'ARMES DU MIRAGE 2000 INTERFACE HOMME MACHINE] c54**
G. Varin *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The multipurpose role of the Mirage 2000 aircraft led to the design of a very complex weapon system which includes navigation, automatic pilot, radar, and countermeasures. The use of such a system which already saturates the pilot in combat aircraft actually in service could be still more difficult in the Mirage 2000. In face, considering the maneuverability qualities of the aircraft, which is largely augmented by electric flight control, the Air Army could introduce new combat techniques which would be more trying and more constraining for the pilot. In order to best utilize the capabilities of the Mirage 2000, an important integration effort was made at the cabin level to realize the best compromise in the presentation of parameters and of the controls at the pilot station: displays highly adapted to each flight phase, multiplexed control, and synthetic representation of tactical situations. Transl. by A.R.H.

N80-30024# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
TORNADO - AIRCREW SYSTEMS c54
E. P. Beck (Royal Navy) *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 7 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

Aspects of the aircrew equipment assembly (AEA) for Tornado, including the cabin environment, the escape system, personal equipment and associated supply systems, and survival equipment are considered. The size rolls and integration of preproduction standard items comprising the various AEAs are validated, unforseen man/seat/cockpit incompatibilities are identified, limitations to be imposed on the aircrew population acceptable for Tornado on account of critical anthropometric dimensions are defined, and proposed aircrew drills for strapping-in, emergency ground egress, etc., are refined. E.D.K.

N80-30025# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
INFORMATION TRANSFER FOR IMPROVED PILOT PERFORMANCE c53
Robert N. Lutter *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The missile intercept confidence factor (MICF) concept was developed to provide the pilot with information about the engagement dynamics of an air-to-air missile engagement. It attempts to account for the critical parameter target maneuver by bounding the possible aerodynamic boundaries, by calculating upper and lower boundary limits. A no-escape target maneuver is utilized to establish the lower boundary and the current maneuver is used for the upper boundary. The MICF factor relates the pilot's position relative to these two boundaries and a minimum range boundary. As an interceptor varies its position within the missile launch envelope boundaries, the MICF varies between a value of zero to one and presents the pilot with an indication of the increasing/decreasing goodness of his launch condition. The MICF allows the pilot to be interactive with the fire control system. Through an assessment of the tactical situation, the pilot can determine whether to accept a low confidence launch or to maneuver to a more favorable launch position. E.D.K.

N80-30026# Panavia Aircraft G.m.b.H., Munich (West Germany). Flight Operations.
HUMAN FACTORS ASPECTS IN HIGH SPEED LOW LEVEL FLIGHT c54
James L. Dell *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 4 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

Human factors aspects of high speed, low level flying are discussed. There is a direct relationship between crew comfort and operational efficiency. The following areas of comfort are discussed: flying clothing; combined harness, arm, leg, and head restraints; helmets; anti-g protection; ejector seats; cockpit conditioning; cockpit layout; noise aspects; and ride comfort. Other topics include workload and workload sharing, physiological and psychological aspects, spatial disorientation, and detachment phenomenon. E.D.K.

N80-30027# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ADDRESSING HUMAN FACTOR OPTIONS IN CONCEPTUAL DESIGN c54
Philip V. Kulwicki *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

The interplay of human factors technology with systems design disciplines during the conceptual phase of development is discussed. Such design features as a full bubble canopy for unobscured vision, fly by wire primary flight control system, modified ejection seat position for better comfort and G-relief and the hands-on-throttle-and-stick concept for improved subsystem management are examples of the benefits of addressing human factor options in conceptual design. E.D.K.

N80-30028# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
HUMAN FACTORS IN MIRAGE 2000 MISSIONS [FACTEURS HUMAINS DES MISSIONS DU MIRAGE 2000] c54
Henri Vieillefond *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

Like modern aircraft, the Mirage 2000 is characterized essentially by a great degree of controllability, an aptitude to perform at high altitude, and a lessening of the pilot's workload. These three essential characteristics require that the pilot adapt to his aircraft. The great controllability implies very brutal variations of intense accelerations which the pilot must endure. Toleration of repeated accelerations is still poorly understood, especially over a long period, consequently pilot selection must be rigorous. The physiopathological effects of high altitude are better known and effective protection can be proposed. The chances of mission success are real only if the pilot has at his disposal a comfortable environment, which involves ergonometric studies of the seat, of controls, of protective equipment, and of cabin ventilation. Transl. by A.R.H.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-30029 Stanford Univ., Calif.
INTERACTION OF RESPONSES TO ACOUSTIC AND ELECTRIC STIMULI AT THE AUDITORY CORTEX Ph.D. Thesis
Hugh Sherbon Lusted 1980 82 p
Avail: Univ. Microfilms Order No. 8016846

The interaction of tone pips and electrical pulses to the auditory nerve was studied. The evoked cortical response to each type of stimulus was recorded from the primary auditory cortex of barbiturate anesthetized cats. The stimuli were then delivered in time delayed pairs where the interstimulus interval was within the refractory period of the evoked response (typically 50 msec) to either stimulus alone. The amplitude of the cortical response to the trailing stimulus was compared with its single stimulus amplitude as the frequency of the tone pips was changed from 250 through 40 kHz. Results are reported. Dissert. Abstr.

N80-30030 Duke Univ., Durham, N. C.
THE STRUCTURE OF FIBRINOGEN AND ITS INTERMOLECULAR ASSOCIATIONS Ph.D. Thesis
Walter Earle Fowler 1980 120 p
Avail: Univ. Microfilms Order No. 8017140

Fibrinogen was prepared by shadowing with platinum in the conventional manner and by a novel technique of negative staining, which has not previously been used with fibrinogen. With the electron microscope, images were obtained that show a single consistent structure for the fabrinogen molecule in both types of preparations, conforming the trinocular model for fibrinogen. Plasmin degradation products of fibrinogen were examined in the electron microscope using the same preparatory techniques and the structures of these proteolytic fragments were related to the trinodular structure of the intact molecule. This work demonstrates structurally the sequence of events which occurs during the proteolysis of fibrinogen and also allows the well known effects of the various fragments on fibrin polymerization to be interpreted in structrural terms. The mechanism of fibrin polymerization was studied by many different techniques, but the location of intermolecular contact sites on the trinodular molecule and the packing arrangement of these molecules in the fibrin fiber are not known. Fibrinogen dimers were studied in the electron microscope using the same techniques that we developed for the study of single fibrinogen molecules and it was determined that their mode of association is end to end and linear. Evidence is presented that this intermolecular contact and arrangement are the same within the fibrin fiber. Dissert. Abstr.

N80-30031# Systems Research Labs., Inc., Dayton, Ohio.
EFFECTS OF BACKGROUND ILLUMINATION AND TARGET CONTRAST ON FLASHBLINDNESS RECOVERY TIME
David C. Smedley and Diana R. Nelson Wright-Patterson AFB, Ohio AMRL Apr. 1979 18 p refs
(Contract F00615-76-C-5001)
(AD-A071906; AMRL-TR-79-30) Avail: NTIS HC A02/MF A01 CSCL 06/16

Seven subjects were shown a series of Landolt Cs with gaps oriented one of eight compass directions. After a randomly occurring flash, the subjects were asked to identify the gap orientation of the target. A tungsten halogen lamp was used as the flash source. The duration was 100 msec and the luminance was 60000 foot lamberts. Five background luminances (16,62,120,230, and 575 foot lamberts) and four target contrast

ratios (0.1,0.2,0.3 and 0.5) were used in this experiment. Results show recovery times at the 0.1 contrast level differ significantly from those obtained at the other levels regardless of background. Recovery times on the 16 foot lambert background level were significantly different from all other backgrounds regardless of contrast. There were no differences between recovery times at the other constrast levels or background luminances. Author

N80-30032# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

ACCELERATION AND PERFORMANCE MODELING WORKSHOP

Ensor Rodriguez-Lopez, ed., James H. Veghte, ed., and Patricia M. Lewandowski, ed. Dec. 1979 38 p refs Conf. held at Washington, D.C., 14-17 May 1979

(Contract F33615-78-C-0501; AF Proj. 7231)

(AD-A083700; AMRL-TR-79-111) Avail: NTIS HC A03/MF A01 CSCL 06/19

A workshop, sponsored by the Aerospace Medical Research Laboratory, was held to exchange current knowledge in the area of acceleration and performance modeling and to provide future guidance. Representatives from the Air Force, US Navy Medical Research Laboratories as well as distinguished academicians participated in this workshop. Two current modeling approaches were presented and provided the basis of later discussions. The participants responses to this effort in this area were favorable and future topics for another meeting were discussed. GRA

N80-30033# SRI International Corp., Arlington, Va.

ON THE INTERACTION OF NON-IONIZING RADIATION WITH PEOPLE

Malvin A. Ruderman and Gordon J. MacDonald Mar. 1980 47 p refs

(Contract MDA903-78-C-0086; ARPA Order 2504)

(AD-A082538; SRI-JSR-79-14) Avail: NTIS HC A03/MF A01 CSCL 06/18

This report examines the physical basis for many of the thermal and non-thermal interactions between microwaves and the human body. Although a microwave beam incident on the human body dissipates, on the average, about the same amount of heat as does normal metabolism, it can actually dissipate considerably more heat in certain local regions of the body because of strong beam focusing effects (e.g., within the brain), flow of induced currents through small, constricted areas of the body (e.g., ankle, neck) and differences in electrical properties among body tissues. Since relatively large heat dissipation can occur on a local level, it would appear more rational to determine a maximum permissive radiation exposure in terms of maximum allowed dissipation in a specific sensitive part of the body rather than, as is presently done, in terms of external beam intensity (the present U.S. standard is 10 milliwatts/sq cm). For non-thermal processes, no special biological process or structure has been identified as likely to be especially sensitive to microwave fields or frequencies. The experimental results designed to explore the non-thermal effect of microwaves were studied. The results of all experiments purporting to demonstrate a significant non-thermal biological effect have been disputed. In fact, very few experiments in the entire field have ever been replicated; a situation which should be rectified. GRA

N80-30034# Kentucky Univ., Lexington.

RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES Final Report, 1 Oct. 1978 - 30 Sep. 1979

Charles F. Knapp Nov. 1979 52 p refs

(Contract F49620-79-C-0034; AF Proj. 2312)

(AD-A081879; AFOSR-80-0203TR) Avail: NTIS HC A04/MF A01 CSCL 06/19

Cardiovascular regulation of acceleration-induced pressure and flow disturbances entails a complex pattern of afferent and efferent neural activity. The global nature of the stress in the levels applied invokes a response from both low and high pressure sensory areas as well as possible mechano-vestibular mechanisms. In this light, it was felt that the dual activation of both peripheral and cardiac efferent activity in response to acceleration stress would disguise the contribution from either mechanisms separately and for that reason a preparation was sought which would allow for delineation of these reactions. As a result, a canine chronic preparation that included a surgically denervated heart thereby permitting a detailed analysis of the peripheral vascular contribution to berostatic regulation has been developed. GRA

N80-30035# Old Dominion Univ., Norfolk, Va. Performance Assessment Lab.

PHYSIOLOGICAL INFLUENCES UPON THE WORK PERFORMANCE OF MEN AND WOMEN Final Report, 1 Nov. 1977 - 31 Dec. 1979

Glynn D. Coates, Raymond H. Kirby, Nancy K. Eberhardt, and Sarah J. Miller Dec. 1979 121 p refs

(Grant AF-AFOSR-3512-78; AF Proj. 2312)

(AD-A081947; ITR-79-22; AFOSR-80-0201TR) Avail: NTIS HC A06/MF A01 CSCL 06/19

The synthetic-work methodology of the Multiple Task Performance Battery (MTPB) was employed in a series of studies designed to determine the effects of 48 hours of continuous work and sleep loss on the work performance of four groups of female subjects and one group of male subjects. The specific female groups were defined in the design by a factorial combination of the phase of the menstrual cycle at the beginning of the sleep-loss period (i.e., Menstrual vs Mid-Cycle) and whether or not the subjects were using contraceptive pills (i.e., Pill vs Normally Cycling). The performances of these four groups of female subjects were compared with those of a group of male subjects who performed the tasks of the MTPB under identical conditions; comparisons were performed during training, during a baseline period, during the sleep-loss, continuous-work period, and during a post-recovery period. An extension of these studies subsequently compared the performances of two groups of female subjects (i.e., Normally Cycling and Pill) for an additional five weeks under normal work conditions; the purpose of this extension was to assess the effects of the phases of the menstrual cycle on work performance. GRA

N80-30036# Texas Univ. Health Science Center, San Antonio.

EFFECTS OF INSPIRED OXYGEN ON THE METABOLISM OF PULMONARY SURFACTANT Final Report, Jun. 1977 - Sep. 1979

Richard J. King, Marita King, and Helen Martin Oct. 1979 31 p refs

(Grant AF-AFOSR-3323-77; AF Proj. 2312)

(AD-A082006; AFOSR-80-0178TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Exposure to 100% oxygen at 1 atm. pressure has compromising effects on the ability of the lung to carry out gas exchange. The initial stages of injury include decreases in lung compliance, fluid accumulation in interstitial and alveolar spaces, and alveolar atelectasis. It is unknown whether pulmonary surfactant undergoes compositional or functional changes prior to or during the observed pathophysiology. Such alterations, if occurring, would interfere with normal physiological function and could exacerbate other effects of the environmental challenge. In order to better define alterations in surfactant that may result from breathing enriched concentrations of oxygen we exposed pathogen-free Wistar rats to 100% oxygen for 48 hours. In separate experiments we injected 3H-palmitate into rats and followed its incorporation and metabolism in the DSPC of Type 2 cells, alveolar surfactant, and alveolar macrophages. The results indicated that the DSPC moved from Type 2 cells to the alveolus, and at least part was ingested by alveolar macrophages. Overall metabolic flux was unchanged in animals exposed to oxygen. We conclude that breathing 100% oxygen for 48 hours has direct effects on the amount of surfactant in the lung, but probably no effect on the metabolic pathways which regulate its phospholipid composition. These differences probably occur because of metabolic changes in catabolic processes associated with the clearance of surfactant. GRA

N80-30037# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.

RADIOFREQUENCY RADIATION AND LIVING TISSUE: THEORETICAL STUDIES Interim Report, Jan. 1978 - May 1979

Richard A. Albanese and Earl L. Bell Dec. 1979 44 p refs (AF Proj. 7757)

(AD-A085952; SAM-TR-79-41) Avail: NTIS HC A03/MF A01 CSCL 06/18

Basic mechanisms whereby radiofrequency electromagnetic radiation can interact with living tissue were investigated. An elementary statistical physics model of tissue, viewed as a chemical mixture, was considered, followed by a nonquantum physics analysis of macromolecular motion in an electromagnetic field. These studies of basic mechanisms suggest that radiofrequency electromagnetic radiation may be important in its effect on living tissue without causing significant tissue-temperature rises. GRA

N80-30038*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ASSESSMENT OF THE EFFECTS OF THE ZERO GRAVITY ENVIRONMENT ON THE HEALTH AND SAFETY OF SPACE WORKERS

18 Feb. 1980 17 p refs

(Contract DE-AI02-79CH-10025)

(NASA-TM-81122; DOE/CH-10025) Avail: NTIS HC A02/MF A01 CSCL 06S

A review was conducted of currently available information relating to adverse effects to the health and safety that space power system (SPS) space workers may experience. Currently available information on the responses of humans to space flight is somewhat limited and was obtained under conditions which are grossly different from conditions to be experienced by future space workers. The limitations in information and differences in conditions were considered in the assessment of potential health and safety hazards to the SPS space workers. The study did not disclose any adverse effects that would result in long term deviations to the medical physiological health of space workers so long as proper preventive or ameliorating action were taken. DOE

N80-30039# National Technical Information Service, Springfield, Va.

BIONICS. CITATIONS FROM THE NTIS DATA BASE

Progress Report, 1970 - Apr. 1980

Brian Carrigan May 1980 138 p Supersedes NTIS/PS-79/0568; NTIS/PS-78/0550

(PB80-810641; NTIS/PS-79/0568; NTIS/PS-78/0550) Avail: NTIS HC $30.00/MF $30.00 CSCL 06D

Recent advances in visual information processing, electronic models of nerve cells, and biological sonar systems are discussed in these citations. Theory and applications are included, along with computerized simulation and signal processing. Electrophysiology and modelling of the central nervous system are also included. This updated bibliography contains 132 abstracts, 12 of which are new entries to the previous edition. GRA

N80-30040*# New Mexico Univ., Albuquerque. Technology Application Center.

CIRCADIAN RHYTHMS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE

Progress Report, 1973 - Jan. 1980

George E. Zollars Apr. 1980 42 p Sponsored by NASA and NTIS

(NASA-CR-163323; PB80-809908) Avail: NTIS HC $30.00/MF $30.00 CSCL 06D

A bibliography containing citations to the international literature concerning circadian rhythms is presented. Topics covered are sleep, body temperature, work-rest cycles, hormone metabolisms, and human physiological responses to various activity cycles. GRA

N80-29995# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).

THERMIC PROBLEMS PRESENTED BY HIGH-SPEED, LOW-LEVEL FLIGHT [PROBLEMES THERMIQUES POSES PAR LE VOL A GRANDE VITESSE ET A BASSE ALTITUDE]

J. Timbal and J. Colin *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs In FRENCH (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

N80-29996# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

EFFECTS ON PERFORMANCE OF THERMAL STRAIN ENCOUNTERED DURING HIGH-SPEED, LOW-LEVEL FLIGHT

T. M. Gibson, J. R. Allan, C. J. Lawson, and R. G. Green *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

N80-29997# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.

AIRCREW HEAT STRESS DURING HIGH-SPEED, LOW-LEVEL FLIGHT

Richard F. Stribley and Sarah A. Nunneley *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

N80-29999# Naval Aerospace Medical Research Lab., New Orleans, La.

A METHOD FOR STUDYING HUMAN BIODYNAMIC RESPONSES TO WHOLE-BODY Z-AXIS

J. C. Guignard, C. L. Ewing, G. C. Willems, W. Anderson, W. H. Muzzy, III, D. J. Thomas, and P. L. Majewski *In* AGARD High-Speed, Low-Level Flight Mar. 1980 7 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

N80-30000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. for Flugmedizin.

HEAD MOVEMENTS INDUCED BY VERTICAL VIBRATIONS

L. Vogt, E. Schwartz, and H. Mertens *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

N80-30005# Naval Aerospace Medical Research Lab., New Orleans, La.

CLINICAL MEDICAL EFFECTS OF HEAD AND NECK RESPONSE DURING BIODYNAMIC STRESS EXPERIMENTS

D. J. Thomas, C. L. Ewing, P. L. Majewski, and N. S. Gilbert *In* AGARD High-Speed, Low-Level Flight Mar. 1980 15 p refs (For primary document see N80-29990 20-51)

Avail: NTIS HC A14/MF A01

N80-30012# Naval Air Systems Command, Washington, D. C.

RESEARCH FOR VISUAL ENHANCEMENT FOR HIGH SPEED LOW LEVEL FLIGHT SPONSORED BY THE NAVAL AIR SYSTEMS COMMAND

H. Rosenwasser, Gloria Twine Chisum (NADC, Warminster, Pa.), J. J. Kulik (Naval Training Equipment Center), M. L. Wolbarsht (Duke Univ.), M. M. Cohen (NADC, Warminster, Pa.), and A. Lewis (Cornell Univ.) *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)

(Contracts N00019-78-C-0431; N00019-78-C-3036)

Avail: NTIS HC A14/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-30041# Naval Aerospace Medical Research Lab., Pensacola, Fla.

A REVIEW OF DYNAMIC VISUAL ACUITY Interim Report

Tommy R. Morrison Mar. 1980 28 p refs

(MF51524004; MR0410103)

(AD-A085860; NAMRL-Monograph-28) Avail: NTIS HC A03/MF A01 CSCL 06/16

In many everyday situations relative motion exists between human beings and the visual information which they must acquire and resolve in order to perform their tasks successfully. In particular, tasks, such as flying aircraft, driving automobiles and

other vehicles, and resolving moving information presented via visual displays, impose a requirement on the human operator to process moving information. Since Dynamic Visual Acuity (DVA) is a critical visual skill involved in performing such visual tasks, the present review was undertaken in order to better understand the visual skill and to provide a basis for continuing research in this area. GRA

N80-30042# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN PERFORMANCE: PSYCHOLOGICAL AND SEX DIFFERENCES, A SELECTED BIBLIOGRAPHY
Gerald A. Hudgens and Linda L. Torsani-Fatkin Feb. 1980 163 p
(AD-A085824) Avail: NTIS HC A08/MF A01 CSCL 05/10

The bibliography is a compilation of 1571 references dealing with, or related to, the effects of sex differences on human performance. The material is organized into four categories: An Overview of Sex Differences, Physiological Sex Differences, Sex Differences in Cognitive and Motor Abilities, and Sex Differences in Personality. The time period covered is roughly from the 1930's into 1979. An index of first authors is included. GRA

N80-29994# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BIOTECHNOLOGY CHALLENGES PRESENT IN OPERATIONAL HIGH-SPEED LOW-LEVEL FLIGHT
Roy L. DeHart *In* AGARD High-Speed, Low-Level Flight Mar. 1980 6 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30004# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
THE EFFECT OF TURBULENCE ON HELMET MOUNTED SIGHT AIMING ACCURACIES
N. O. Tatham *In* AGARD High-Speed, Low-Level Flight Mar. 1980 4 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30007# Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe (West Germany).
TV OPERATOR PERFORMANCE IN REAL TIME AIR-TO-GROUND RECONNAISSANCE MISSIONS UNDER TASK-LOADING CONDITIONS
H. Mutschler *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs Sponsored by the German Federal Ministry of Defense (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30025# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
INFORMATION TRANSFER FOR IMPROVED PILOT PERFORMANCE
Robert N. Lutter *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-30043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRESSURE SUIT JOINT ANALYZER Patent Application
Hubert C. Vykukal and Bruce Webbon, inventors (to NASA) Filed 11 Jul. 1980 13 p
(NASA-Case-ARC-11314-1; US-Patent-Appl-SN-168943) Avail: NTIS HC A02/MF A01 CSCL 06Q

A measurement system for simultaneously measuring torque and angular flexure in a pressure suit joint. One end of a joint under test is held rigid, and a torque transducer is pivotably supported on the other movable end of the joint. A potentiometer is attached to the transducer by an arm. The wiper shaft of the potentiometer is gripped by a reference arm that rotates the wiper shaft the same angle as the flexure of joint. A signal, generated by the potentiometer, is representative of the joint flexure angle, and a compensation circuit coverts the output of the transducer to a signal representative of joint torque. NASA

N80-30044# Technology, Inc., San Antonio, Tex. Life Sciences Div.
PROCEDURAL TESTS FOR ANTI-G PROTECTIVE DEVICES. VOLUME 2: G-SENSITIVITY TESTS Final Report, 1 Oct. 1976 - 30 Jun. 1978
Roy W. Thompson, Carmen E. Galvin, James E. Allred, Paul E. Love, and Larry J. Meeker Dec. 1979 203 p
(Contract F33615-77-C-0610; AF Proj. 7930)
(AD-A085982; SAM-TR-79-31-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 06/11

In this volume, an examination of anti-G valve failures is reported, as well as the results of 9 short term investigation dealing with acceleration protection equipment and studies on the USAFSAM Human Centrifuge. These studies involved: the CWU-9/P undergarments; the Statham PM131TC pressure transducer; the Ready Pressure Anti-G valve; the ALAR 'High flow' and 'Special' anti-G valves; accelerometer calibration, continuous ECG recording; control-center data distribution; closed-loop centrifuge control; and the Medilog recorder. GRA

N80-30045# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THERMAL AND ACCELERATION EFFECTS ON AIRCREW MEMBERS IN CHEMICAL DEFENSE GEAR Technical Report, Nov. 1978 - Jan. 1979
Ronald E. Yates, Clyde R. Replogle, and James H. Veghte Jan. 1980 36 p refs
(AF Proj. 6893)
(AD-A086026; AFAMRL-TR-79-71) Avail: NTIS HC A03/MF A01 CSCL 06/19

An experiment was conducted to determine the combined thermal and acceleration effects on aircrew members in chemical defense protective gear in a simulated air-to-ground mission. The subject flew two sorties per day in the Dynamic Environment Simulator. The environmental conditions simulated were typical of a 95th percentile hot summer central European day. Most of the responses seen in the subjects can be attributed to the thermal stress caused by the hot temperatures and the heavy protective clothing. GRA

N80-30046# Essex Corp., Alexandria, Va.
HUMAN ENGINEERING DESIGN CRITERIA FOR MODERN CONTROL/DISPLAY COMPONENTS AND STANDARD PARTS Final Report
David R. Eike, Thomas B. Malone, Stephen A. Fleger, and Jimmie H. Johnson May 1980 171 p refs
(Contract DAAK40-79-C-0144)
(AD-A086139; DRSMI/RS-CR-80-1) Avail: NTIS HC A08/MF A01 CSCL 05/8

A study was conducted to identify requirements for modification of MIL-STD-1472B to include human engineering design criteria for modern controls and displays; and to reduce the incidence of requests for waiver of MIL-STD-1472 resulting from unavailability of standard parts. Recommended changes are presented with rationales and references. GRA

N80-29991# Royal Air Force, Farnborough (England).
RIDE-BUMPINESS AND THE INFLUENCE OF ACTIVE CONTROL SYSTEMS
J. G. Jones *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29992# Amt fuer Wehrgeophysik, Traben-Trarbach (West Germany).
INFLUENCES OF GEOPHYSICAL FACTORS (METEOROLOGICAL AND TOPOGRAPHICAL) ON THE PILOT-AIRCRAFT-SYSTEM IN HIGH SPEED LOW LEVEL FLIGHT (HSLLF)
Karl Krames *In* AGARD High-Speed, Low-Level Flight Mar. 1980 46 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29993# British Aerospace Aircraft Group, Preston (England).
DEVELOPMENT IN HIGH-SPEED LOW-LEVEL FLIGHT: THE PILOT'S VIEWPOINT
J. J. Lee *In* AGARD High-Speed, Low-Level Flight Mar. 1980 3 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-29998# Laboratoire Central de Biologie Aerospatiale, Paris (France).
QUANTIFYING THE AGRESSION GENERATED BY LOW FREQUENCY VIBRATIONS [ESSAI DE QUANTIFICATION DE L'AGRESSION ENGENDREE PAR LES VIBRATIONS DE BASSE FREQUENCE]
P. Quandieu, P. Borredon, J. C. Rouhet, and L. Pellieux *In* AGARD High-Speed, Low-Level Flight Mar. 1980 17 p refs In FRENCH (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30001# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF RECLINED SEATING ON THE TRANSMISSION OF LINEAR VIBRATION TO THE HEAD
Mary E. Johnston *In* AGARD High-Speed, Low-Level Flight Mar. 1980 14 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30002# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
THE EFFECTS OF AIRCRAFT VIBRATION ON VISION
G. R. Barnes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 11 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30003# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF 3-25 Hz VIBRATION ON THE LEGIBILITY OF NUMERIC LIGHT EMITTING DIODE DISPLAYS
Mary E. Johnston and John H. Wharf *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30006# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPERATIONAL ASPECTS OF GUIDANCE AND CONTROL ADVANCES VERSUS PILOT WORKLOAD FOR LOW ALTITUDE, HIGH SPEED FLIGHT
Morris A. Ostgaard *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30008# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
THE INFLUENCE OF THE DESIGN OF DISPLAYS ON COCKPIT WORKLOAD
R. H. Holmes *In* AGARD High-Speed, Low-Level Flight Mar. 1980 10 p (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30009# Marconi Avionics Ltd., Rochester (England). Airborne Display Div.
COLOUR DISPLAYS: THEIR AVAILABILITY, PERFORMANCE AND APPLICATION TO IMPROVED CREW EFFICIENCY
D. W. Hussey *In* AGARD High-Speed, Low-Level Flight Mar. 1980 12 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30010# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
HELMET-MOUNTED DEVICES IN LOW-FLYING HIGH-SPEED AIRCRAFT
D. N. Jarrett *In* AGARD High-Speed, Low-Level Flight Mar. 1980 9 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30011# Naval Air Development Center, Warminster, Pa.
THE ROLE OF HELMET MOUNTED DISPLAYS IN HIGH-SPEED LOW-LEVEL FLIGHT
Gloria Twine Chisum *In* AGARD High-Speed, Low-Level Flight Mar. 1980 5 p refs (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30014# Naval Aerospace Medical Research Lab., New Orleans, La.
CREW STATION ASSESSMENT USING THE BIOMAN MODELING SYSTEM
Georg D. Frisch, Louis A. Daulerio, and Michael Schultz *In* AGARD High-Speed, Low-Level Flight Mar. 1980 16 p refs Prepared in cooperation with NADC, Warminster, Pa. (For primary document see N80-29990 20-51)
Avail: NTIS HC A14/MF A01

N80-30023# French Air Force, Bretigny sur Orge. Centre d'Essais en Vol.
WEAPONS SYSTEMS OF THE MIRAGE 2000: MAN MACHINE INTERFACE [LE SYSTEME D'ARMES DU MIRAGE 2000 INTERFACE HOMME MACHINE]
G. Varin *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30024# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
TORNADO - AIRCREW SYSTEMS
E. P. Beck (Royal Navy) *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 7 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30026# Panavia Aircraft G.m.b.H., Munich (West Germany). Flight Operations.
HUMAN FACTORS ASPECTS IN HIGH SPEED LOW LEVEL FLIGHT
James L. Dell *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 4 p (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30027# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ADDRESSING HUMAN FACTOR OPTIONS IN CONCEPTUAL DESIGN
Philip V. Kulwicki *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 15 p refs (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

N80-30028# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
HUMAN FACTORS IN MIRAGE 2000 MISSIONS [FACTEURS HUMAINS DES MISSIONS DU MIRAGE 2000]
Henri Vieillefond *In* AGARD Operational Roles, Aircrew Systems and Human Factors in Future High Performance Aircraft Mar. 1980 6 p refs In FRENCH (For primary document see N80-30019 20-51)
Avail: NTIS HC A05/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N80-30047 Oklahoma Univ., Norman.
A NEW METHOD FOR REALIZING PARALLEL PROCESSING MACHINES USING MULTIPLE-VALUED LOGIC Ph.D. Thesis
Monte Paul Tull 1980 212 p
Avail: Univ. Microfilms Order No. 8016936

The application of r-valued logic for the development of logic circuits that function as m identical but independent q-valued logic circuits, r = q(m), is explored. The resulting machine exhibits inherent parallelism wherein the logic values of the m sub-machines are multiplexed within the r levels of the multiple-valued logic, and the r-valued memory elements simultaneously store the logic states of the m machines. Multiple-valued digital circuits and systems processing these attributes are said to be state integrated and logic multiplexed. For the case q = 2, (m) identical binary machines can be combined into one r-valued r = 2 (m) machine that provides the same functions as a parallel binary machines. Further, given a single binary logic circuits, either combinational or sequential, m copies of the circuit can be constructed directly in a 2 (m) logic system. Each binary sub-circuit operates in parallel and independently of the other m-1 sub-circuits. To aid the sequential circuit design process, a new multiple-valued memory element is developed that simultaneously stores information for the independent binary sub-machines.
Dissert. Abstr.

N80-30048 Maryland Univ., College Park.
AN EXPERIMENTAL INVESTIGATION OF COMPUTER PROGRAM DEVELOPMENT APPROACHES AND COMPUTER PROGRAMMING METRICS Ph.D. Thesis
Robert William Reiter, Jr. 1979 152 p
Avail: Univ. Microfilms Order No. 8016993

Three programming environments were compared: individual programming under an ad hoc approach; team programming under an ad hoc approach; and team programming under a disciplined methodology. This disciplined methodology combined the use of reading, and chief programmer team organization. Data was obtained for a large number of automatable software metrics characterizing the software development process and the developed software product. The results reveal several statistically significant differences among the programming environments on the basis of the metrics. These results are interpreted as demonstrating the advantages of disciplined team programming in reducing software development costs relative to ad hoc approaches and improving software product quality relative to undisciplined team programming.
Dissert. Abstr.

N80-30049 Illinois Univ. at Urbana-Champaign.
MULTIPROCESSORS: DISCUSSION OF SOME THEORETICAL AND PRACTICAL PROBLEMS Ph.D. Thesis
David Alejandro PaduaHaiek 1980 133 p
Avail: Univ. Microfilms Order No. 8018194

Three problems in the design and use of multiprocessors were studied. A multiprocessor organization with the capability of executing both array and scalar instructions was outlined. The design of the processor/memory interconnection network was analyzed. Compiler algorithms for the translation of sequential programs into parallel programs suitable for execution in a multiprocessor were evaluated. Some theoretical problems were surveyed with respect to the fact that the allocation of processors to a parallel program is a time consuming operation.
Dissert. Abstr.

N80-30050*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RECONFIGURING REDUNDANCY MANAGEMENT Patent Application
Hendrik C. Gelderloos, inventor (to NASA) (Honeywell, Inc., St. Petersburg, Fla.) Filed 30 Jul. 1980 21 p Sponsored by NASA
(NASA-Case-MSC-18498-1; US-Patent-Appl-SN-173518) Avail: NTIS HC A02/MF A01 CSCL 09B

Input singals from sensors in a redundancy management system are provided redundantly in parallel so that a primary control signal may be selected. Median value signals from groups of three sensors are detected in median value selectors of selection filters. The detected median value signals are then also compared in a subtractor/comparator to determine whether any of them exceeds the others by an amount greater than the signal level for a failed sensor. If so, the lowest level detected medium value signal is sent as the primary control signal.
NASA

N80-30051# United Technologies Research Center, East Hartford, Conn.
MICROPROCESSOR REQUIREMENTS FOR IMPLEMENTING MODERN CONTROL LOGIC Final Technical Report, 1 Mar. 1979 - 29 Feb. 1980
Robert W. Guile, James R. Krodel, and Florence A. Farrar Apr. 1980 87 p refs
(Contract F49620-79-C-0078; AF Proj. 2304)
(AD-A085994; UTRC/R80-944590-1; AFOSR-80-0443TR)
Avail: NTIS HC A05/MF A01 CSCL 09/2

A demonstration of the use of microprocessors for implementing linear quadratic Gaussian (LQG) control was conducted. The demonstration consisted of simulating linear system dynamics on an analog computer and implementing LQG control and estimation dynamics on a microprocessor. Two cases were studied -- a single input second order system and a four input fifth order system. The second order system was controlled using an Intel 8080 8-bit microprocessor and fifth order system was controlled using a 16-bit Digital Equipment Corp LSI 11/2 microprocessor. Key requirements addressed include microprocessor requirements for: (1) word size; (2) computational capability, including arithmetic and input/output operations; and (3) memory requirements. The requirements were compared against predicted requirements made using previously developed analytic techniques. The implementation involved developing general purpose algorithms required for implementing LQG control and estimation. These algorithms consisted of matrix/vector multiplication, vector addition and input/output service routines. The same algorithms were employed in both the second order and the fifth order demonstration.
GRA

N80-30052# Harris Corp., Melbourne, Fla. Government Communications Systems Div.
MULTIPLE MICROPROCESSOR SYSTEM (MMS) DESIGN STUDY, VOLUME 3 Final Report
Griffiss AFB, N.Y. RADC Mar. 1980 36 p
(Contract F30602-78-C-0114; AF Proj. 2529)
(AD-A086245; RADC-TR-80-33-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 09/2

This is a design for a Multiple Microprocessor System (MMS) to be built as part of the System Architecture Evaluation Facility (SAEF) being developed at RADC. The MMS was designed to be used in the modeling of a wide range of multiprocessor configurations for the purpose of evaluating their suitability to unique Air Force data processing requirements.
GRA

N80-30053# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
MULTIHEAD AND MULTITAPE REAL TIME TURING MACHINES
Paul M. B. Vitanyi Jun. 1979 14 p refs Submitted for publication

(MC-IW-111/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Previous results which show that a k-head tape unit can be simulated in real time by a 4k-4 tape Turing machine are reviewed. It is observed that 2 tape Turing machines are more powerful in real time than 1 tape Turing machines. Furthermore, more read-write heads are shown to yield additional power in real time. Specifically, it follows that a 4k-3 head tape unit is more powerful than a k-head tape unit in real time. It is shown that (k+1)-head tape units are more powerful in real time than k-head tape units. Closure properties are investigated for classes of languages accepted by real time Turing machines with k one-head tape or one k-head tape. Author (ESA)

N80-30054# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.

COMPUTER SCIENCE AND TECHNOLOGY: APPLICATION OF MEASUREMENT CRITERIA IN THE SELECTION OF INTERACTIVE COMPUTER SERVICE Final Report

Paul D. Amer Apr. 1980 95 p refs

(PB80-177645; NBS-SP-500-58; LC-80-600035) Avail: NTIS HC A05/MF A01 CSCL 09B

The data analysis component of the computer service selection process is addressed. A computer service selection model is presented and three binary type selection procedures applicable in the measurement phases of that model are given. As a result of employing these procedures, those services that perform below the performance level can be eliminated or penalized depending on whether the performance specification is mandatory or desirable in nature. The procedures explicitly specify prior to measurement an appropriate selection rule and/or the number of test measurements required in a comparision effort to attain a given level in statistical confidence in the results. Data from a case study are analyzed to illustrate application of the selection procedures. GRA

N80-30055# Maryland Univ., College Park. Dept. of Computer Science.

COMPUTER SCIENCE AND TECHNOLOGY: DATA ABSTRACTION, DATABASES, AND CONCEPTUAL MODELLING. AN ANNOTATED BIBLIOGRAPHY Final Report

Michael L. Brodie May 1980 91 p Sponsored by NBS

(PB80-183833; NBS-SP-500-59; LC-80-600052) Avail: NTIS HC A05/MF A01 CSCL 09B

A bibliography containing 350 entries on issues within the area of conceptual modelling of dynamic systems of complex data is given. The entries are from recent work in the areas of database management, programming languages, artificial intelligence, and software engineering. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-30056 Stanford Univ., Calif.

LANGUAGE AND ENVIRONMENT FOR MULTI-LEVEL SIMULATION Ph.D. Thesis

Dwight Douglass Hill 1980 185 p

Avail: Univ. Microfilms Order No. 8016830

A methodology is proposed for modeling and simulating computer systems. It makes use of a language called 'ADLIB' for specifying the behavior of computer subsystems, and a special environment called 'SABLE' for modeling their interactions. The ADLIB language is designed to be compatible with existing computer languages, since it is a superset of PASCAL. The SABLE environment accepts topological specifications written in a standard format, and uses them to allocate and interconnect the functional units described in ADLIB. This union of behavioral and structural design specifications makes it possible to apply type checking to hardware design. Ramifications of this are discussed for automatically detecting design errors at the interfaces between components. Language constructs are presented that can effectively model both synchronous and asynchronous systems to any degree of accuracy. In addition, a mechanism supporting the concurrent simulation of multiple levels of abstraction is developed. Several examples illustrate the description and simulation of systems ranging from distributed computer networks to individual logic gates. Dissert. Abstr.

N80-30057 Carnegie-Mellon Univ., Pittsburgh, Pa.

GEOMETRIC TRANSFORMS FOR FAST GEOMETRIC ALGORITHMS Ph.D. Thesis

Kevin Quentin Brown 1979 156 p

Avail: Univ. Microfilms Order No. 8012772

The use of geometric transforms as algorithmic tools for constructing fast geometric algorithms is discussed. Several geometric problems whose solutions illustrate the use of geometric transforms are described. These include fast algorithms for interseting half-spaces, constructing Voronoi diagrams, and computing the Euclidean diameter of a set of points. For each of the major transforms a set of heuristics is included. Dissert. Abstr.

N80-30058 New York Univ., N. Y.

AN IMPLEMENTATION FOR GYVE: A LANGUAGE FOR CONCURRENT PROCESSING Ph.D. Thesis

Jeanine Marietta Meyer 1980 627 p

Avail: Univ. Microfilms Order No. 8017579

A design for implementing a programming language, called GYVE for specifying groups of concurrent processes such as operating systems is presented. Important features of GYVE include compile time protection checking, explicit scheduling of processes and a dynamic destroy function. A detailed review of most of the constructs of GYVE is given as well as methods of how various features could be modified so as to ease the implementation and/or increase performance in certain situations. One such feature concerns accessing of shared objects. The syntactic and semantic phases of a GYVE compiler as well as the runtime structures and procedures required for execution of output from the compiler are specified. Dissert. Abstr.

N80-30059 Auburn Univ., Ala.

A CODE-BASED MODEL FOR PREDICTING PATH FAULTS IN COBOL PROGRAMS Ph.D. Thesis

Robert Francis Roggio 1980 228 p

Avail: Univ. Microfilms Order No. 8018179

A static analyzer was developed to specifically identify infeasible paths (source code to which there is no logical path) in COBOL programs that are currently operational on B3500/B3700/B4700 computer systems. By exercising the static analyzer on over 500 COBOL source programs, data were drawn and a large data base was constructed to support further analysis of the problem. Simple linear as well as multiple variable models based on fourteen program characteristics were used for indicating path faults in COBOL programs. By applying the models to existing COBOL programs, it was possible to determine those programs that would benefit from the expenditure of resources for static analysis in attempts to improve overall system reliability. Dissert. Abstr.

N80-30060*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE). VOLUME 3: THE GREEDY ALGORITHM

Edwin Dupnick and Diana Wiggins (Lockheed Electronics Co., Inc., Houston, Tex.) Feb. 1980 37 p

(NASA-TM-81116; JCS-16395-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 09B

The functional specifications, functional design and flow, and the program logic of the GREEDY computer program are described. The GREEDY program is a submodule of the Scheduling Algorithm for Mission Planning and Logistics Evaluation (SAMPLE) program and has been designed as a continuation of the shuttle Mission Payloads (MPLS) program. The MPLS uses input payload data to form a set of feasible payload combinations; from these, GREEDY selects a subset of combinations (a traffic model) so all payloads can be included without redundancy. The program also provides the user a tutorial option so that he can choose an alternate traffic model in case a particular traffic model is unacceptable. M.G.

N80-30061*# Colorado Univ. at Boulder.
FLIGHT SOFTWARE REQUIREMENTS AND DESIGN SUPPORT SYSTEM Final Report
William E. Riddle and Bryan Edwards Aug. 1980 18 p
(Grant NsG-1638)
(NASA-CR-163425) Avail: NTIS HC A02/MF A01 CSCL 09B

The desirability and feasibility of computer-augmented support for the pre-implementation activities occurring during the development of flight control software was investigated. The specific topics to be investigated were the capabilities to be included in a pre-implementation support system for flight control software system development, and the specification of a preliminary design for such a system. Further, the pre-implementation support system was to be characterized and specified under the constraints that it: (1) support both description and assessment of flight control software requirements definitions and design specification; (2) account for known software description and assessment techniques; (3) be compatible with existing and planned NASA flight control software development support system; and (4) does not impose, but may encourage, specific development technologies. An overview of the results is given. R.K.G.

N80-30062*# Colorado Univ. at Boulder. Dept. of Computer Science.
FUNCTIONAL SPECIFICATIONS OF THE ANNULAR SUSPENSION POINTING SYSTEM, APPENDIX A
Bryan Edwards Jan. 1980 22 p
(Grant NsG-1638)
(NASA-CR-163419; CU-CS-171-80-APP-A; RSSM/99-App-A) Avail: NTIS HC A02/MF A01 CSCL 09B

The Annular Suspension Pointing System is described. The Design Realization, Evaluation and Modelling (DREAM) system, and its design description technique, the DREAM Design Notation (DDN) is employed. R.K.G.

N80-30063*# Colorado Univ. at Boulder. Dept. of Computer Science.
TOOLS TO AID THE SPECIFICATION AND DESIGN OF FLIGHT SOFTWARE, APPENDIX B
Guy Bristow Jan. 1980 11 p refs
(Grant NsG-1638)
(NASA-CR-163420; CU-CS-168-80-App-B; RSSM/97-App-B) Avail: NTIS HC A02/MF A01 CSCL 09B

The tasks that are normally performed during the specification and architecture design stages of software development are identified. Ways that tools could perform, or aid the performance, of such tasks are also identified. Much of the verification and analysis that is suggested is currently rarely performed during these early stages, but it is believed that this analysis should be done as early as possible so as to detect errors as early as possible. R.K.G.

N80-30064*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT TOOLS: A BIBLIOGRAPHY, APPENDIX C.
William E. Riddle Jun. 1980 13 p
(Grant NsG-1638)
(NASA-CR-163421; CU-CS-183-80-App-C; RSSM/103-App-C) Avail: NTIS HC A02/MF A01 CSCL 09B

A bibliography containing approximately 200 citations on tools which help software developers perform some development task (such as text manipulation, testing, etc.), and which would not necessarily be found as part of a computing facility is given. The bibliography comes from a relatively random sampling of the literature and is not complete. But it is indicative of the nature and range of tools currently being prepared or currently available. R.K.G.

N80-30065*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT ENVIRONMENTS: PRESENT AND FUTURE, APPENDIX D
William E. Riddle 1980 8 p refs Repr. from the Proc. Intern. Computer Technol. Conf., Aug. 1980 8 p Presented at the Intern. Computer Technol. Conf., San Francisco, Aug. 1980
(Grant NsG-1638)
(NASA-CR-163426; RSSM/96-App-D) Avail: NTIS HC A02/MF A01 CSCL 09B

Computerized environments which facilitate the development of appropriately functioning software systems are discussed. Their current status is reviewed and several trends exhibited by their history are identified. A number of principles, some at (slight) variance with the historical trends, are suggested and it is argued that observance of these principles is critical to achieving truly effective and efficient software development support environments. Author

N80-30066*# Colorado Univ. at Boulder.
AN ASSESSMENT OF DREAM, APPENDIX E
William E. Riddle 1980 32 p refs Repr. from Software Eng. Environ. (Amsterdam), 1980 32 p
(Grant NsG-1638)
(NASA-CR-163422; RSSM/100-App-E) Avail: NTIS HC A03/MF A01 CSCL 09B

The design realization, evaluation and modelling (DREAM) system is evaluated. A short history of the DREAM research project is given as well as the significant characteristics of DREAM as a development environment. The design notation which is the basis for the DREAM system is reviewed, and the development tools envisioned as part of DREAM are discussed. Insights into development environments and their production are presented and used to make suggestions for future work in the area of development environments. A.R.H.

N80-30067*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT ENVIRONMENT, APPENDIX F
William E. Riddle Oct. 1980 12 p Presented at the COMPSAC 80 Panel, Chicago, Oct. 1980
(Grant NsG-1638)
(NASA-CR-163423; CU-CS-182-80-App-F) Avail: NTIS HC A02/MF A01 CSCL 09B

The current status in the area of software development environments is assessed. The purposes of environments, the types of environments, the constituents of an environment, the issue of environment integration, and the problems which must be solved in preparing an environment are discussed. Some general maxims to guide near-term future work are proposed. R.K.G.

N80-30068*# Colorado Univ. at Boulder. Dept. of Computer Science.
SOFTWARE DEVELOPMENT ENVIRONMENTS: A BIBLIOGRAPHY, APPENDIX G
William E. Riddle Jun. 1980 10 p
(Grant NsG-1638)
(NASA-CR-163424; CU-CS-184-80-App-G; RSSM/104-App-G) Avail: NTIS HC A02/MF A01 CSCL 09B

A bibliography containing approximately 100 citations on software development environments is given. The bibliography comes from a relatively random sampling of the literature and is not complete. R.K.G.

N80-30069# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Computer Science.
DIALOG: A SIMULA CLASS FOR WRITING INTERACTIVE PROGRAMS
Richard J. Orgass and Robert E. Porter 14 Oct. 1979 28 p
(Grant AF-AFOSR-0021-70; AF Proj. 2304)
(AD-A085516; VPI-SU-TM-79-3A) Avail: NTIS HC A03/MF A01 CSCL 09/2

A SIMULA class containing procedures for easily writing programs that interact with a user by asking questions at run time and which dynamically name and open files at run time is described. The class uses properties of IBM SIMULA that are not available in other implementations. It also depends on the EBCDIC character codes rather than ASCII but it is assumed that a user's terminal is an ASCII terminal. This revised report describes a number of extensions of DIALOG. While most programs using the old version will work correctly with the new version, there are many enhancements and users are advised to reread all Sections 3 to 9. GRA

N80-30070# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Computer Science.

CONVERTING DEC-10 SIMULA PROGRAMS TO CMS SIMULA

Richard J. Orgass 30 Jul. 1979 11 p

(Grant AF-AFOSR-0021-79; AF Proj. 2304)

(AD-A085517; VPI-SU-TM-79-7; AFOSR-80-0447TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This note reports on the writer's experience moving DEC-10 SIMULA programs to CMS and executing the programs with CMS SIMULA. The languages implemented by the two compilers is the same and this makes the transfer of SIMULA programs very easy. In contrast, it is very difficult to transfer FORTRAN programs from a DEC-10 to CMS. The two main sources of difficulty in transferring programs are the differences in the character set and file system of the two systems and the fact that CMS lacks many of the capabilities that TOPS-10 users take for granted. The directions for moving DEC-10 SIMULA programs to IBM SIMULA that are provided with release 3 refer to older versions of IBM SIMULA and it is now possible to preserve most of the separately compiled classes and procedures while moving programs to CMS SIMULA. GRA

N80-30071# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.

TOWARDS A THEORY FOR ABSTRACT DATA TYPES Ph.D. Thesis

Deepak Kapur Jun. 1980 255 p refs

(Contract N00014-75-C-0661; Grant NSF MCS-74-21892)

(AD-A085877; MIT/LCS/TR-237) Avail: NTIS HC A12/MF A01 CSCL 09/2

A rigorous framework for studying immutable data types having nondeterministic operations and operations exhibiting exceptional behavior is developed. The framework embodies the view of a data type taken in programming languages, and supports hierarchical and modular structure among data types. The central notion in this framework is the definition of a data type. An algebraic and behavioral approach for defining a data type is developed which focuses on the input-output behavior of a data type as observed through its operations. The definition of a data type abstracts from the representational structure of its values as well as from the multiple representations of the values for any representational structure. A hierarchical specification language for data types is proposed. A deductive system based on first order multi-sorted predicate calculus with identity is developed for abstract data types. A correctness criterion is proposed for an implementation coded in a programming language with respect to a specification. It is defined as a relation between the semantics of an implementation and the semantics of a specification. It does not require a correct implementation to have the maximum amount of nondeterminism specified by a specification. A methodology for proving correctness of an implementation is developed which embodies the correctness criterion. GRA

N80-30072# Army Engineer Topographic Labs., Wright-Patterson AFB, Ohio.

ADVANCED FEATURE SYMBOLIZATION FOR THREE-DIMENSIONAL VIEWS Technical Report, Jun. - Jul. 1979

Brian J. Cullis Apr. 1980 53 p

(AD-A085872; ETL-0223) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report documents initial research into the development of line-drawn symbols for point features in tactical terrain computer graphics. In this report, 21 significant point features for aircraft in tactical operations were selected for study. Symbols were designed for these 21 point features, with primary emphasis placed upon enhancing rapid user recognition, minimizing computer drawing time and computer storage requirements. Three candidate computer storage strategies, X-Y Absolute, Starburst and Run-Length-Starburst, were evaluated. The most efficient storage strategy for these symbols was the X-Y Absolute technique. The symbols were digitized, and software was developed to plot them in conjunction with existing three-dimensional terrain view software. GRA

N80-30073# General Electric Co., Arlington, Va. Information Systems Programs.

MEASUREMENT AND EXPERIMENTATION IN SOFTWARE ENGINEERING

Bill Curtis 30 Apr. 1980 63 p refs

(Contract N00014-79-C-0595)

(AD-A085827; TR-80-388200-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

The contributions of measurement and experimentation to the state-of-the-art in software engineering are reviewed. The role of measurement in developing theoretical models is discussed, and concerns for reliability and validity are stressed. Current approaches to measuring software characteristics are presented as examples. In particular, software complexity metrics related to control flow, module interconnectedness, and Halstead's Software Science are critiqued. The use of experimental methods in evaluating cause effect relationships is also discussed. Example programs of experimental research which investigated conditional statements and control flow are reviewed. The conclusion argues that advances in software engineering will be related to improvements in the measurement and experimental evaluation of software techniques and practices. GRA

N80-30074# California Univ., Livermore. Lawrence Livermore Lab.

IMPROVED MONOTONE PIECEWISE CUBIC INTERPOLATION ALGORITHM

F. N. Fritsch 1 Apr. 1980 34 p refs Submitted for publication

(Contract W-7405-eng-48)

(UCID-18620) Avail: NTIS HC A03/MF A01

A modification of Butland's formula for derivative values that define a monotone piecewise cubic interpolant to monotone data is presented. The algorithm preserves the simplicity of Butland's method while producing visually pleasing curves comparable to the original Fritsch-Carlson algorithm. DOE

N80-30075# Oak Ridge National Lab., Tenn. Computer Science Div.

INTERACTIVE VARPO (INVAR), A NONLINEAR LEAST SQUARES PROGRAM

J. E. Rall and R. E. Funderlic May 1980 99 p refs

(Contract W-7405-eng-26)

(ORNL/CSD-55) Avail: NTIS HC A05/MF A01

An interactive program developed for solving either linear or nonlinear least squares problems is described. The program is designed for use from a remote computer terminal, and provides the user with on-line feedback and the opportunity to make changes or corrections during execution of the program. The program has been run on the DEC10 System. The least squares method used takes special advantage of the structure of the model equation by treating the unknown parameters as linear or nonlinear depending on how they appear in the model. Initial estimates need to be provided only for the nonlinear parameters. The program is especially designed for use by people with a minimal knowledge of FORTRAN programing. However, a FORTRAN subroutine, which defines the model, must be supplied by the user. DOE

N80-30076# California Univ., Berkeley. Lawrence Berkeley Lab.

INTERACTIVE COMPUTER GRAPHICS DISPLAYS FOR HIERARCHICAL DATA STRUCTURES

D. F. Cahn and C. V. Murano May 1980 12 p refs Presented at the American Society for Information Service Mid-Year Meeting, Pittsburgh, Pa., 15 May 1980

(Contract W-7405-eng-48)

(LBL-10247; CONF-800529-1) Avail: NTIS HC A02/MF A01

A subroutine was developed as an aid to user visualization and manipulation of hierarchically structured data systems such as thesauri. In the present configuration, a thesaurus term and its primary and secondary conceptual manipulation of hierarchically structured data systems such as thesauri. In the present configuration, a thesaurus term and its primary and secondary conceptual neighbors are presented to the user in tree graph form on a CRT; the user then designates, via light pen or keyboard, any of the neighbors as the next term of interest and receives a new display centered on this term. By successive specification of broader, narrower, and related terms, the user can course

rapidly through the thesaurus space and refine his search file. At any stage, he deals with a term-centered, conceptually meaningful picture of a localized portion of the thesaurus, and is freed from the artificial difficulties of handling the traditional alphabetized thesaurus. Intentional limitation of the associative range of each display frame, and the use of color, case, and interconnecting vectors to encode relationships among terms, enhance interpretability of the display. DOE

N80-30077# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DIMENSIONAL REDUCTION VARIANT OF KHACHIAN'S ALGORITHM FOR LINEAR PROGRAMMING PROBLEMS
Philip C. Jones and Earl S. Marwil [1980] 20 p refs
(Contract EY-76-C-07-1570)
(IDO-1570-T38) Avail: NTIS HC A02/MF A01

A technique for dimensional reduction is combined with Khachian's algorithm and another acceleration technique to solve linear programing problems. The method yields exact rather than approximate solutions, and provides a natural procedure for determining infeasibility. DOE

N80-30078# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
GOTO STATEMENTS: SEMATICS AND DEDUCTION SYSTEMS
A. deBruin Jun. 1979 55 p refs Submitted for publication
(MC-IW-74/79) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 6

A simple language containing goto statements is presented together with denotational and operational semantics for it. Equivalence of these semantical descriptions is proven. Furthermore, soundness and completeness of a Hoare-like proof system for the language is shown via two steps. First, a proof system is given and validity is defined using a variant of direct semantics. In this case soundness and completeness proofs are relatively easy. After that, a proof system is given which is more in the style of program proving using jumps and functions. Validity in this system is defined through continuation semantics. This validity definition is then related to validity in the first system, and using this correspondence, soundness and completeness for the second system is proven. Author (ESA)

N80-30079# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
A FAST GARBAGE COMPACTION ALGORITHM
H. B. M. Jonkers Mar. 1979 21 p refs Submitted for publication
(MC-IW-107/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A compaction algorithm for variable size storage elements is described for use in a compacting garbage collector. Under certain plausible assumptions on the structure of these storage elements, the algorithm requires no space overhead and is faster than any compaction algorithm published to date. It scans the area to be compacted twice, but examines pointers only once. Author (ESA)

N80-30080# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
SPACE-BOUNDED COMPLEXITY CLASSES AND ITERATED DETERMINISTIC SUBSTITUTION
Peter R. J. Asveld Apr. 1979 24 p refs Submitted for publication
(MC-IW-108/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The effect on space complexity is investigated for a language family K extended by means of iterated lambda free deterministic substitution to the family eta (K). If each language in K is accepted by a one way nondeterministic multitape Turing machine within space S(n) > or = log N, then eta (K) is included in NSPACE(S(n)). Thus, for each monotonic space bound S(n) > or = N, the inclusion K as a subclass within NSPACE (S(n)) implies that eta (K) is also included in NSPACE(S(n)). An implication similar to the latter one also holds for DSPACE(S(n)). Consequently, some well-known space-bounded complexity classes such as the families of nondeterministic context sensitive languages, of two nondeterministic nonerasing stack automation languages, and PSPACE are abstract family of languages closed under intersection and iterated lambda free deterministic substitution. On the other hand, no space-bounded complexity class which includes DSPACE(log n) is closed under controlled iterated lambda free nondeterministic substitution. Author (ESA)

N80-30081# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
ON CONTROLLED ITERATED GSM MAPPINGS AND RELATED OPERATIONS
Peter R. J. Asveld Aug. 1979 14 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-114/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Families of languages generated iterated generalized sequential machine (GSM) mappings, iterated finite substitutions, and iterated homomorphisms are considered. The relation between iterated finite substitutions (homomorphisms) and (deterministic) tabled context independent Lindenmayer systems is discussed. Author (ESA)

N80-30082# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
CORRECTNESS THEORIES AND PROGRAM EQUIVALENCE
J. A. Bergstra (Leiden Univ.), J. Tiuryn (Warsaw Univ.), and J. V. Tucker Sep. 1979 37 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-119/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The mathematical concept that a programming language semantics can be sensibly determined by proof rules for the before-after assertions required true of programs in the language was investigated. It is shown that the theory of program correctness based on first order logic can in a natural way specify the basic semantical concept of program equivalence in the case of programs terminating throughout any given class of data structures, but that diverging programs require rather delicate investigations into the associated classes. Author (ESA)

N80-30083# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
MODULAR PROGRAMMING FOR MULTICOMPUTER SYSTEMS
W. Gruenewald Mar. 1979 81 p refs In GERMAN; ENGLISH summary
(FFM-277) Avail: NTIS HC A05/MF A01

A task-oriented modular programming scheme was tried out on a multi-minicomputer system. As a test problem, a simulation system involving 30 tasks was microprogrammed, the simulation being handled by microprocessors. Results show the value of a task oriented approach to sequential programming and processing in terms of software resource management by the operating system. Problems in parallel processing do not arise. Multiple machine intercommunication is considered. However, further analysis of communication language structure is still needed to optimize system efficiency. Author (ESA)

N80-30084# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DIGITAL IMAGE RESTORATION
K. vonderHeide Aug. 1979 82 p refs In GERMAN; ENGLISH summary
(FFM-286) Avail: NTIS HC A05/MF A01

A deterministic parametric approach to digital image reconstruction and enhancement, which avoids the use of Fourier transformations, was investigated. The image restoration problem is handled on the basis of the method of least squares. Both object intensity and the point spread function were modeled as stochastic processes. A simple positivity constraint was introduced and a dynamic data smoothing algorithm was used. Some test measurements from numerical simulations were reconstructed as one dimensional images after implementing the method in an ALGOL program. The program was only intended to show the validity of this method and was not optimized for run time. Author (ESA)

N80-30085# Software Management Consultants, Torrance, Calif.
SOFTWARE TOOL TAXONOMY ANNOTATED BIBLIOGRAPHY
Donald J. Reifer and Harold A. Montgomery 1 Dec. 1979 38 p Prepared in cooperation with SoHaR Inc., Los Angeles, Calif.
(Contract NB79-SBCA-0273)
(PB80-176902; SMC-SOH-79-0001; NBS-GCR-80-199) Avail: NTIS HC A03/MF A01 CSCL 09B

A literature search was conducted to identify source material useful in the development of a software tool taxonomy. The findings are organized into three parts. Twelve articles which deal with taxonomies are summarized. Each article is abstracted and evaluated in terms of its strengths and weaknesses. An annotated bibliography of 30 articles which survey, compare and/or report experience with tools is included and 197 references which were reviewed during the investigation are listed. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-30086*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MACHINE INTELLIGENCE AND ROBOTICS: REPORT OF THE NASA STUDY GROUP. EXECUTIVE SUMMARY
Sep. 1979 23 p
(NASA-CR-163380; JPL-730-51) Avail: NTIS HC A02/MF A01 CSCL 09B

A brief overview of applications of machine intelligence and robotics in the space program is given. These space exploration robots, global service robots to collect data for public service use on soil conditions, sea states, global crop conditions, weather, geology, disasters, etc., from Earth orbit, space industrialization and processing technologies, and construction of large structures in space. Program options for research, advanced development, and implementation of machine intelligence and robot technology for use in program planning are discussed. A vigorous and long-range program to incorporate and keep pace with state of the art developments in computer technology, both in spaceborne and ground-based computer systems is recommended. J.M.S.

N80-30087# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A COUPLING DEVICE OF THE FFM-1 MULTICOMPUTER SYSTEM
W. Langer Apr. 1979 50 p refs In GERMAN; ENGLISH summary
(FFM-278) Avail: NTIS HC A03/MF A01

The hardware of a computer coupler which is installed in a multi-minicomputer system is described. This device allows any combination of connections between the computers to be made. In order to achieve automatic system operation, the coupler is also equipped with fully user programmable operation modes.
Author (ESA)

N80-30088# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
FUNCTION MODULES OF THE FFM-MULTICOMPUTER SYSTEM
W. Jansen Jun. 1979 52 p refs In GERMAN; ENGLISH summary
(FFM-282) Avail: NTIS HC A04/MF A01

The hardware of task-specific function modules in a multi-minicomputer system is described. These modules have to perform object functions in the experimental, homogeneous network. They support the operating system kernel which is programmed into each autonomous computer of the multicomputer system. Additionally, timer modules are described. They are used to measure task run times for the specific programs and to control the exact timing of the tasks. Author (ESA)

N80-30089# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
THE FFM-MULTICOMPUTER SYSTEM: SYSTEM GUIDE
W. Bauer Jun. 1979 120 p refs In GERMAN; ENGLISH summary
(FFM-283) Avail: NTIS HC A06/MF A01

The implementation of the operating system kernel of a multi-minicomputer system is explained. The kernel hardware is only briefly discussed. Emphasis is on the concepts and the code necessary to microprogramming the operating system. They consist of the routines for task and processor management, for machine message intercommunication, and for the handling of 'supervisor calls'. A complete listing of documentation relevant to this system is also provided. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N80-30090 Stanford Univ., Calif.
OPTIMAL ESTIMATION AND CONTROL OF LINEAR TIME-INVARIANT SYSTEMS WITH UNCERTAIN PARAMETERS Ph.D. Thesis
Victor Shenkar 1980 253 p
Avail: Univ. Microfilms Order No. 8016864

The systems under investigation are linear time-invariant ones, with uncertain parameters assumed to be a random vector with known statistics. The quadratic integral criterion is averaged with respect to the uncertain parameter statistics, and then used as an optimization object. Two existing sensitivity methods are reviewed, and a more accurate method is suggested. Some considerations concerning stability, in the presence of uncertain parameters, are made. The necessary conditions for optimal control laws of a regulator, estimator and compensator, in the presence of uncertain parameters, are given. The uncertain parameters are assumed to have a small range of variations, and the so-called small-sensitivity analysis is conducted. Closed-form solutions for linearized optimal gains of a regulator, estimator and compensator are found and some important insight into the sensitivity analysis gained. A computer program, based on the established theory, is developed and applied to solve some illustrative examples. Dissert. Abstr.

N80-30091# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
AN AVERAGING METHOD FOR STOCHASTIC APPROXIMATIONS WITH CONSTANT PARAMETERS: SMALL PARAMETER VALUES
H. J. Kushner Mar. 1980 24 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-77; NSF ENG-77-12946)
(AD-A085831) Avail: NTIS HC A02/MF A01 CSCL 12/1

Stochastic approximations with constant gain coefficients and dependent noise and nonlinear or even 'discontinuous dynamics' have many applications in control, automata and communication theory. When the gain coefficient is small, an asymptotic theory is developed which gives much information on the character of the paths and errors. The method involves both 'averaging' and 'stability' ideas. The ideas are outlined. An example which illustrates the basic ideas and techniques is given. GRA

N80-30092# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
NON-UNIQUENESS IN SINGULAR OPTIMAL CONTROL
J. Grasman Mar. 1979 8 p refs Submitted for publication
(MC-TW-188/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Singular optimal control problems of linear, time invariant n-dimensional dynamic systems, having performance index represented by a symmetric positive semidefinite matrix, are investigated. A finite dimensional linear state space is denoted and the system is assumed controllable. The control vector u has its values in a linear m-dimensional space and u(t) is assumed to be continuous for $t > zero$. It is shown that there exists a class of linear singular optimal control problems with a non-unique singular arc. The problems in this class have a controllability subspace in which the trajectories may vary without affecting the performance index. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-30093 New Mexico State Univ., University Park.
A REAL-TIME SOLUTION TECHNIQUE FOR STIFF LINEAR DIFFERENTIAL SYSTEMS Ph.D. Thesis
Karl H. Agar 1980 96 p
Avail: Univ. Microfilms Order No. 8017439

The problem of obtaining real time solutions via digital computational hardware for stiff, linear, time-invariant system models, suitable for hardware in the loop application is addressed. A solution technique that is A-stable and suitable to real time processing, requiring very few sequential arithmetic steps is discussed. The method is capable of handling arbitrary stiffness within the numerical capacity of the hardware employed and requires no model scaling. The solution technique is a considerable departure from conventional differential equation solvers in that it lays the theoretical foundation for taking advantage of desk top type general purpose computers in conjunction with a special purpose digital processor implementing algorithms based on the trapezoidal rule. Dissert. Abstr.

N80-30094 Illinois Univ. at Urbana-Champaign.
A COMPOSITE ALGORITHM FOR MIXED INTEGER CONSTRAINED NONLINEAR OPTIMIZATION Ph.D. Thesis
Daniel Bryan Fox 1980 232 p
Avail: Univ. Microfilms Order No. 8017937

A composite optimization algorithm applicable to mixed integer, constrained, nonlinear problems was developed. Significant modifications were made to this algorithm including the incorporation of a unidimensional search procedure and the use of an improved method to treat constraints. Additional features of the composite algorithm include acceleration strategies, a decomposition approach, and a discrete grid algorithm. The components of the composite algorithm were tested on problems primarily selected to represent engineering design optimization applications. The performance of the methods was compared to some existing techniques. The results indicate that the algorithms obtain superior solutions and in most cases are more efficient than existing techniques. The success of the algorithm on problems of engineering design optimization indicates a wide area of potential application. Dissert. Abstr.

N80-30095*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A COMPUTER PROGRAM FOR DETERMINING TRUNCATION ERROR COEFFICIENTS FOR RUNGE-KUTTA METHODS
M. Kathleen Horn Jul. 1980 27 p refs
(NASA-TM-81143; JSC-16429; Rept-80-FM-13) Avail: NTIS HC A03/MF A01 CSCL 12A

The basic structure of a program to generate the truncation error coefficients for Runge-Kutta (RK) methods is reformulated to reduce storage requirements significantly and to accommodate variable dimensioning. This FORTRAN program, SUBROUTINE RKEQ, determines truncation error coefficients for RK algorithms for orders 1 through 10 and extends the order of coefficients through 12 with the 11th- and 12th-order terms determined following the patterns used to establish the lower order coefficients. Both subroutines (the original and RKEQ) are also written to treat RK m-fold methods which utilize m known derivatives of f to increase the order of the algorithm. Setting m = 0 gives the classical RK algorithm. M.G.

N80-30096# Wisconsin Univ. - Madison. Dept. of Statistics.
BOUNDS FOR OPTIMAL CONFIDENCE LIMITS FOR SERIES SYSTEMS
Bernard Harris (Wisconsin Univ., Milwaukee) and Andrew P. Soms May 1980 11 p refs
(Contracts N00014-79-C-0321; DAAG29-75-C-0024)
(AD-A085741; UWIS-DS-80-611) Avail: NTIS HC A02/MF A01 CSCL 12/1

Lindstrom-Madden type approximations to the lower confidence limit on the reliability of a series system are theoretically justified by extending and simplifying the results of Sudakoc (1973). Applications are made to Johns (1976) and Winterbottom (1974). Numerical examples are presented. GRA

N80-30097# Naval Postgraduate School, Monterey, Calif.
A MIXED EXPONENTIAL TIME SERIES MODEL NMEARMA (P,Q)
A. J. Lawrance (Birmingham Univ., England) and P. A. W. Lewis Mar. 1980 18 p refs
(Contract N00014-80-WR-00054; RR0000110)
(AD-A085316; NPS55-80-012) Avail: NTIS HC A02/MF A01 CSCL 12/1

A first-order stochastic difference equation with random coefficients is shown to have a solution which makes the marginal distribution of the stationary sequence generated by the equation a convex mixture of two exponential distributions. This Markovian process should be broadly applicable in stochastic modelling in operations analysis. Moreover it can be extended quite simply to a mixed exponential process with mixed pth-order autoregressive and qth-order moving average correlation structure. Coupling of the processes to model multivariate situations is also discussed. GRA

N80-30098# Ballistic Research Labs., Aberdeen Proving Ground, Md.
***CONFIDENCE BOUNDS FOR THE LINEAR MODEL OF* INTRODUCTION TO G-INVERSE**
Kali S. Banerjee May 1980 31 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A086094; AD-E430459; ARBRL-IR-02241) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper explains the use of Scheffe's theorem on simultaneous confidence bounds in the context of linear hypothesis model of less than the full rank. In paving the background, some results on the uniqueness of estimates in the theory of singular designs are brought together in a compact form in this report with a brief explanatory introduction to the solution of linear equations as related to the computation of a g-inverse. GRA

N80-30099# Yale Univ., New Haven, Conn. Dept. of Statistics.
TESTS FOR JOINT NORMALITY IN TIME SERIES
Francis J. Anscombe and Ho-len H. Chang May 1980 13 p refs
(Contract N00014-75-C-0563)
(AD-A085885; TR-47) Avail: NTIS HC A02/MF A01 CSCL 12/1

The well-known methods for analysis of time series, whether in the time domain or in the frequency domain, for fitting parametric structures, for regression, for forecasting, all involve second-moment statistics. If all variables are jointly normally distributed in stationary sequences, simple first and second moments contain all the information. If not, there is the possibility that some of the needed information is not contained in the statistics used. When a random sequence is other than stationary and jointly normal, it may sometimes equally well be described and thought of as stationary but not jointly normal (which is the terminology used here) or as nonstationary. GRA

N80-30100# Society for Industrial and Applied Mathematics, Philadelphia, Pa.
MATHEMATICAL METHODS IN THE ATMOSPHERIC SCIENCES AND RELATED COMPUTATIONAL METHODS Final Report
I. Edward Block Nov. 1979 4 p Symp. held in Denver, 12-14 Nov. 1979
(Grant AF-AFOSR-0119-79; AF Proj. 2304)
(AD-A086242; AFOSR-80-0475TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The program consisted of twelve invited lecturers, two von Karman prize recipients, and one hundred thirty-three contributed papers and poster presentations. The program was organized into three symposia: Mathematical Methods in the Atmospheric Sciences, Computational Methods in Partial Differential Equations, and Adaptive Methods for Scientific Computation. The Symposium on Mathematical Methods in the Atmospheric Sciences was held on Monday, November 12. The atmospheric and related sciences provide an abundant source of problems in applied mathe-

matics. Often problems in these areas are characterized by their extensive use of computing resources. Those attending realized they could make substantial contributions not only to the analysis of these problems, but also to the efficient use of computing in solving them. GRA

N80-30101# Washington Univ., Seattle. Dept. of Mathematics.

INTERVAL GRAPHS, CHRONOLOGICAL ORDERINGS, AND RELATED MATTERS Ph.D. Thesis

Dale John Skrien May 1980 137 p refs

(Contract N00014-67-A-0103; NR Proj. 044-353)

(AD-A086224; TR-71) Avail: NTIS HC A07/MF A01 CSCL 12/1

This paper is concerned with special interval representations of interval graphs. The basic notion is that of a chronological ordering of an interval graph, which is an equivalence class of interval representations of the graph in question. Consider a reference set P = (l sub 1 ..., (l sub n, r sub 1, ..., r) whose points are to be associated with the respective left and right endpoints of interval representations of a graph having n nodes. Among the questions that are considered in this paper, and are answered both mathematically and algorithmically, are the following: Given an interval graph G with n nodes, which linear orderings on P sub n arise from interval representations of G> Given a partial ordering of P sub n, when can it be expanded to a linear ordering associated with an interval representation of G?, How many chronological ordering does a given interval graph have? The theorems and algorithms are applicable to a variety of seriation problems. GRA

N80-30102# New York Univ., N. Y. Magnetic-Fluid Dynamics Div.

SIMILARITY SOLUTIONS OF SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS USING MACSYMA Interim Report

P. Rosenau and J. L. Schwarzmeter Oct. 1979 26 p refs

(Contract EY-76-C-02-3077; Grant AF-AFOSR-2881-76; AF Proj. 2304)

(AD-A086207; MF-94; COO-3077-160; AFOSR-80-0485TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A Code has been written to use the algebraic computer system MACSYMA to generate systematically the infinitesimal similarity groups corresponding to systems of quasi-linear partial differential equations. The infinitesimal similarity groups can be used to find exact solutions of the partial differential equations. In an example from fluid mechanics, the similarity method using the computer code reproduces immediately a solution obtained from dimensional analysis. GRA

N80-30103# Maryland Univ., College Park. Computer Science Center.

THE BEHAVIOR OF A MULTIPLICITY INDEPENDENT ROOT-FINDING SCHEME IN THE PRESENCE OF ERROR

G. W. Stewart Apr. 1980 8 p refs

(Contract N00014-76-C-0391)

(AD-A086192; TR-890) Avail: NTIS HC A02/MF A01 CSCL 12/1

A derivative free scheme has been proposed that permits root finding methods, such as the secant method to perserve high order convergence when the root in question is multiple. In this note it is shown that the scheme can fail to achieve the maximum accuracy that is attainable at a fixed precision of computations. GRA

N80-30104# Stanford Univ., Calif. System Optimization Lab.

A PROJECTED LAGRANGIAN ALGORITHM FOR NONLINEAR L (SUB 1) OPTIMIZATION

Walter Murray and Michael L. Overton Feb. 1980 40 p refs

(Contracts DAAG29-79-C-0110; DE-AC03-76SF-00326; DE-AC03-76ER-72018; Grants NSF MCS-78-111986; NSF MCS-79-26009)

(AD-A086162; SU-SOL-80-4; ARO-16470.10-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The nonlinear l sub 1 problem is an unconstrained optimization problem whose objective function is not differentiable everywhere, and hence cannot be solved efficiently using standard techniques for unconstrained optimization. The problem can be transformed into a nonlinearly constrained optimization problem, but it involves many extra variables. We show how to construct a method based on projected Lagrangian methods for constrained optimization which requires successively solving quadratic programs in the same number of variables as that of the original problem. Special Lagrange multiplier estimates are used to form an approximation to the Hessian of the Lagrangian function, which appears in the quadratic program. A special line search algorithm is used to obtain a reduction in the l sub 1 objective function at each iteration. Under mild conditions the method is locally quadratically convergent if analytical Hessians are used. GRA

N80-30105# Michigan Univ., Ann Arbor. Dept. of Mathematics.

A FINITE ELEMENT METHOD FOR FIRST ORDER HYPERBOLIC SYSTEMS Interim Report

Mitchell Luskin 1980 47 p refs

(Contract F49620-79-C-0149; AF Proj. 2304)

(AD-A085981; AFOSR-80-0427TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new finite element method is proposed for the numerical solution of a class of initial-boundary value problems for first order hyperbolic systems in one space dimension. An application of our procedure to a system modeling gas flow in a pipe is discussed. Asymptotic error estimates are derived in the L sq norm in space. GRA

N80-30106# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.

FINITE ELEMENT ANALYSIS OF CONVECTIVE HEAT TRANSFER IN A POROUS MEDIUM

David K. Gartling 1979 10 p refs Presented at the 3d Intern. Conf. on Finite Element in Flow Problems, Banff, (Canada), 10 Jun. 1980

(Contract EY-76-C-04-0789)

(SAND-79-1374C; CONF-800613-3) Avail: NTIS HC A02/MF A01

A numerical procedure based on the Galerkin form of the finite element method is developed for the solution of isothermal and non-isothermal flow problems in porous materials. The methodology is demonstrated by application to the classic free convection problem of a saturated porous layer heated from below. Results are presented for steady state flows at low Rayleigh numbers and for an interesting transient flow at a higher Rayleigh number. DOE

N80-30107# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

COMPLEXITY OF LOCATION PROBLEMS ON NETWORKS

Antoon Kolen May 1979 20 p refs

(MC-BW-107/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The theory of computational complexity is briefly discussed, showing the existence of a class of NP-complete problems which are equivalent in the sense that none is known to be solvable in polynomial time. There is also a class of NP-hard problems for which it is conjectured that no polynomial time algorithm exists. Some well-known location problems, namely, the p-center problem (with mutual communication), the simple (capacited) plant location problem, and the maximal covering problem are then considered. It is shown that all these problems are NP-hard. Author (ESA)

N80-30108# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

ALGEBRAIC SPECIFICATIONS OF COMPUTABLE AND SEMICOMPUTABLE DATA STRUCTURES

J. A. Bergstra (Leiden Univ.) and J. V. Tucker Aug. 1979 27 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science

(MC-IW-115/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Theoretical issues relating to algebraic specification methods for data structures are addressed. Results are obtained which show that every computable data structure possesses a special kind of finite, equational hidden functions specification and that every semicomputable data structure possesses a special kind of finite, equational hidden sorts specification. Author (ESA)

N80-30109# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
DERIVATIVES OF PROGRAMS
J. W. deBakker and J. I. Zucker Sep. 1979 18 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-IW-116/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The notions of upper and lower derivations of a recursive (nondeterministic) program are defined and used to characterize termination for such a program in terms of the well foundedness of a function with respect to a predicate. This extends earlier work on induction rules and proofs of termination to the case of nested recursions, formulated in terms of a least fixed point construct. It is shown how this characterization can be interpreted as stating that a recursive procedure always terminates if it exhibits neithe global nor local nondetermination. Author (ESA)

N80-30110# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE STRUCTURE OF AN ADAPTIVE MULTI-LEVEL ALGORITHM
P. W. Hemker May 1979 20 p refs Submitted for publication Sponsored by Netherlands Organization for Advancement of Pure Science
(MC-NW-65/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

The structure of multilevel adaptive algorithms is explained. Their recursive character is exposed by means of the formal language ALGOL 68. The basic structure is given in two forms: course grid corrections to fine grids, and fine grid corrections to coarse grids. The latter description is shown more convenient for the treatment of fully automatic adaptive grids. A full approximation storage, full multigrid algorithm is described, then used in an ALGOL 68 procedure for the solution of boundary value problems with adaptive mesh refinements. Author (ESA)

N80-30111# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
TABLES OF THE FIRST 15,000 ZEROS OF THE RIEMANN ZETA FUNCTION TO 28 SIGNIFICANT DIGITS, AND RELATED QUANTITIES
H. J. J. teRiele Jun. 1979 160 p refs
(MC-NW-67/79) Avail: NTIS HC A10/MF A01; Stichting Math. Centrum, Amsterdam FL 19

A table of the imaginary parts of the first 15,000 zeros rho sub N of the Riemann zeta function, zeta (s), in the critical strip, with an accuracy of 28 significant digits, is given. Moreover, two additional tables of the related quantities 1/the absolute value rho sub N zeta prime (rho sub N), and arg (rho sub N zeta prime (rho sub N)) are given to 10 significant digits. Calculations involve (1) a separation and a zero finding procedure, combined with Gram's law; (2) application of the Reimann-Siegel formula; (3) improvement of the accuracy with the Newton process, which entails (4) substitution of the Euler-MacLaurin formula for the Riemann-Siegel computation of zeta (s). A FORTRAN program on a CDC Cyber 73/173 computer system was used. Author (ESA)

N80-30112# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE TREATMENT OF TIME DEPENDENT BOUNDARY CONDITIONS IN SPLITTING METHODS FOR PARABOLIC DIFFERENTIAL EQUATIONS
B. P. Sommeijer, P. J. vanderHouwen, and J. G. Verwer Jun. 1979 28 p refs Submitted for publication
(MC-NW-68/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A class of splitting method for two-space dimensional parabolic partial differential equations are investigated in reference to the fact that splitting methods usually exhibit a drop in accuracy if boundary conditions become time dependent. A boundary value correction is discussed for the Laplace equation with Dirichlet conditions, then is generalized for a wide class of initial boundary value problems. A numerical comparision is made between the alternating direction implicit method and the locally one-dimensional method as applied to problems with Dirichlet boundary conditions and non-Dirichlet boundary conditions. Results show that when the time-integration error dominates, the accuracy of the locally one-dimensional method decreases. On the other hand, accuracy was satisfactory, for Dirichlet conditions, with a modified version of the alternating direction implicit method. Author (ESA)

N80-30113# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
THE CALCULATION OF EIGENVECTORS AND INVARIANT SUBSPACES
M. Louter-Nool Aug. 1979 46 p refs
(MC-NW-69/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

The algebraic eigenvalue problem of real general matrices, especially of matrices having multiple eigenvalues, is considered. The Schur-decomposition method as a stable method for calculating eigenvalues is chosen. The vectors v sub 1, v sub 2, ... v sub r are said to span an invariant subspace of A of order r if v sub 1, v sub 2, ... v sub r are linearly independent and Av sub i (i = 1, 2, ... r) lies in that same subspace. An algorithm to determine these vectors is given and elucidated. Finally, some PASCAL procedures (with numerical results) for the calculation of eigenvalues of a real, possibly defective and/or derogatory matrix as well as for the calculation of the corresponding eigenvectors and invariant subspaces are presented, along with a theorem on the perturbation of eigenvalues. Author (ESA)

N80-30114# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ANALYSIS OF NUMERICAL METHODS FOR SOLVING SECOND KIND VOLTERRA EQUATIONS BY IMBEDDING TECHNIQUES
P. H. M. Wolkenfelt, P. J. vanderHouwen, and C. T. H. Baker (Manchester Univ.) Sep. 1979 26 p refs Submitted for publication
(MC-NW-71/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The properties of a wide class of numerical methods for second kind Volterra integral equations with an arbitrary smooth, nonlinear, kernel function are examined. For the analysis, the imbedding of the integral equation in a differential equation containing one parameter is proposed. The solution of the integral equation is then related to the solution of the differential equation and this connection suggests a technique for deriving numerical methods, many of which prove to be classical. This connection, is thoroughly explored. Author (ESA)

N80-30115# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE INTERNAL STABILITY OF EXPLICIT m-STAGE RUNGE-KUTTA METHODS FOR LARGE m-VALUES
P. J. vanderHouwen and B. P. Sommeijer Sep. 1979 18 p refs Submitted for publication
(MC-NW-72/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Explicit, m-stage Runge-Kutta methods are derived for which the maximal stable integration step per right hand side evaluation is proportional to m when applied to semidiscrete parabolic initial boundary value problems. The internal stability behavior of these methods is compared with that of similar Runge-Kutta methods proposed in the literature. Both by analysis and by numerical experiments it is shown that the value of m in the schemes proposed is not restricted by internal instabilities. Author (ESA)

N80-30116# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
A NOTE ON SOME METHODS FOR REGRESSION ANALYSIS WITH INCOMPLETE OBSERVATIONS
R. D. Gill Jan. 1979 16 p refs Submitted for publication
(MC-SW-65/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Some related proposals for estimating regresssion coefficients with incomplete experimental observations are discussed. The proposals include 'approximate standard errors' for the estimators. It is shown that the estimators of the regression coefficients are consistent under fairly weak conditions, but that only under rather strong ones can be usual (asymptotic) tests

of significance be validly based on the estimated coefficients and the computated standard deviations. The covariate-sequence of assuming a random or fixed specification for the covariates are also discussed. Author (ESA)

N80-30117# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

THE NUMERICAL COMPUTATION OF SPECIAL FUNCTIONS BY USE OF QUADRATURE RULES FOR SADDLE POINT INTEGRALS: GAMMA FUNCTIONS, MODIFIED BESSEL FUNCTIONS, AND PARABOLIC CYLINDER FUNCTIONS

N. M. Temme Nov. 1978 58 p refs

(MC-TW-183/78) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 7

Quadrature rules were used for the computation of special functions. The functions considered were the Euler gamma function, modified Bessel functions, and parabolic cylinder functions. The starting point was an integral, the quadrature method used for evaluating the integral being the trapezoidal rule. The range of the parameters was chosen such that in the saddle point integrals used, the procedure was not disturbed for some combinations of the variables of the function. It is shown that in the saddle point analysis of the Bessel Functions and the parabolic cylinder functions more than one saddle point of integrand can be considered. The computer programs used are given as ALGOL 60 procedures for the integral representations. Author (ESA)

N80-30118# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

A SINGULAR BOUNDARY VALUE PROBLEM ARISING IN A PRE-BREAKDOWN GAS DISCHARGE

O. Diekmann, D. Hilhorst, and L. A. Peletier Jun. 1979 36 p refs Submitted for publication

(MC-TW-174/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The nonlinear two point boundary value problem epsilon XY double prime + (g(x)-y) prime = 0, y(0) = 0, y(R) = k, where g is a given function is considered. It is proven that the probelem has a unique solution. The limiting behavior of this solution as R approaches infinity and as epsilon decreases to zero is studied. It is shown how a so called prebreakdown discharge in an ionized gas between two electrodes can be described by an equation of this form, leading to a physical interpretation of the mathematical results. Author (ESA)

N80-30119# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

A FRACTIONAL INTEGRAL OPERATOR CORRESPONDING TO NEGATIVE POWERS OF A SECOND ORDER PARTIAL DIFFERENTIAL OPERATOR

I. G. Sprinkhuizen-Kuyper Jun. 1979 47 p refs Submitted for publication

(MC-TW-191/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A fractional integral operator is derived for which the partial differential operator plays a role similar to that of ordinary differentiation (d/dx) with respect to the fractional integral of Riemann-Liouville. An application is given to the Koornwinder polynomials (a class of orthogonal polynomials in two variables). Also, an operator is obtained which has the Jacobi functions of order 1/2 (NU-1), -1/2 as its eigenfunctions. Author (ESA)

N80-30120# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.

ON THE NONEXISTENCE OF A (57, 14, 1) STRONGLY REGULAR GRAPH

H. A. Wilbrink and A. E. Brouwer Dec. 1978 8 p

(MC-ZW-121/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is shown that a strongly regular graph with parameters n = 57, k = 14, lambda = 1, mu = 4 (10,1) - eigenvalues: 1*14, 38*2, 18*(-5); (1,-1)-eigenvalues: 1*28, 38*(-5), 18*9y does not exist. To this effect, an inductive proof is established. Author (ESA)

N80-30121# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

APPROXIMATION OF HARMONIC FUNCTIONS

Bjoern E. J. Dahlberg 1979 13 p refs

(CTH-Math-1979-10) Avail: NTIS HC A02/MF A01

Let u be harmonic in a bounded Lipschitz domain D with a regular boundary. The problem of when it is possible to find functions f sub j whose gradients are measures of bounded variation in D, such that D sup (the absolute value of (f-f sub j)) tends to infinity as j tends to infinity, is studied. Results prove that this approximation is always possible if u is the Poisson integral of a function f, belonging to L sup p (sigma), p > or = 2, where sigma denotes the surface measure of partial differentiation in D. An example is also given which shows that this result does not extend to p < 2. Author (ESA)

N80-30122# Loughborough Univ. of Technology (England). Dept. of Mathematics.

ON THE SPECTRA AND STABILITY OF PERIODIC DIFFERENTIAL EQUATIONS

B. J. Harris Feb. 1978 54 p refs

(Math-Res-124) Avail: NTIS HC A04/MF A01

A Floquet theory is derived for the periodic Dirac equations of relativistic quantum mechanics within a crystal. This theory is used to obtain a relationship between the spectra of certain linear operations on a Hilbert space and the stability regions associated with the Dirac equations. R.C.T.

N80-30123# Loughborough Univ. of Technology (England). Dept. of Mathematics.

ON AN INEQUALITY OF WIRTINGER

B. J. Harris Feb. 1978 10 p refs

(Math-Res-125) Avail: NTIS HC A02/MF A01

Wirtinger's inequality is stated as a complex valued function F defined and absolutely continuous on the closed interval 0, 2 pi such that F prime belongs to L squared 0, 2 pi while, firstly, F(0) = F(2 pi), and secondly, the integral from zero to 2 pi of F(X) dx = zero. Thus the integral from zero to 2 pi of (the absolute value squared (F prime (X))) dx > or = the integral from zero to 2 pi of (the absolute value squared (F(X))) dx. Proofs involving operator theory are considered. An elementary, operator theory proof of a slightly more general inequality is then developed. Author (ESA)

N80-30124# Loughborough Univ. of Technology (England). Dept. of Mathematics.

SOME PERFORMANCE TRIALS AND MODIFICATIONS TO A RATIONAL LINE SEARCH AND A CHEBYSHEV LINE SEARCH

G. A. Evans Mar. 1979 33 p refs

(Math-Res-138) Avail: NTIS HC A03/MF A01

Given a line search, the problem of how to obtain the accurate local minimum with a minimum of objective function evaluations is studied. The Powell quadratic line search is introduced as a reference. Two other line search algorithms, the rational function approach and the Chebyshev-based numerical differentiator, are considered in comparison. Data on efficiency was obtained by replacing the quadratic line search, for which results are known, by each of the other methods. A set of well known test functions was used. Performance test results show that the algorithms using a rational fit are comparable with the quadratic fit of Powell. The Chebyshev method in its current form falls short of the other two algorithms in efficiency. Author (ESA)

N80-30125# Trent Polytechnic, Nottingham (England). Dept. of Mathematical Sciences.

ON AN ALTERNATIVE FORM OF SYSTEM MATRIX FOR DELAY-DIFFERENTIAL SYSTEMS

M. G. Frost and C. Storey (Loughborough Univ. of Technology) Apr. 1979 32 p refs

(Math-Res-139) Avail: NTIS HC A03/MF A01

A form of system matrix over the set of real numbers, corresponding to a delay-differential system, is considered. The possibilty of decomposing a system matrix of this form, using an associated form of a transformation of similarity is also taken into account. To what extent the controllability and observability of such systems depends on the decoupling factors of the system

matrix is examined. Finally, various types of controllability for systems corresponding to system matrices of this form are discussed in connection with previously established concepts of (real numbers) sup n controllability and function space null controllability. Author (ESA)

N80-30126# Trent Polytechnic, Nottingham (England). Dept. of Mathematical Sciences.
ANOTHER FORM OF SYSTEM MATRIX ASSOCIATED WITH DELAY-DIFFERENTIAL SYSTEMS
M. G. Frost and C. Storey (Loughborough Univ. of Technology) Aug. 1979 20 p refs
(Math-Res-142) Avail: NTIS HC A02/MF A01

Various kinds of controllability as well as necessary and sufficient conditions for these types of controllability are defined for a form of system matrix over the set of real numbers, corresponding to a delay differential system. Various types of observability are also defined. To what extent controllability and observability depend on the decoupling factors and zeros of a system matrix of this form is discussed. Of particular interest are system matrices which have delay only in the state as well as system matrices which have delay only in the control term in the input state relationship. Finally, conditions under which associated forms of transformations of similarity exist between these types of system matrices are determined. Author (ESA)

N80-30127# National Bureau of Standards, Washington, D.C. National Engineering Lab.
NUMERICAL SOLUTION OF LINEAR DIFFERENCE EQUATIONS Final Report
Daniel W. Lozier Mar. 1980 170 p refs
(PB80-169980; NBSIR-80-1976) Avail: NTIS HC A08/MF A01 CSCL 12A

Consider a given inhomogeneous linear difference equation summation, s=0 to 1 (d sub s): (r)y(r +S)=g(r) where 1 = or greater than 2 and r = 0,1,2,... . Suppose y is a solution of this equation and u,v are solutions of the homogeneous form such that, as r approaches infinity, u(r)/v(r), y(r)/v(r), and u(r)/y(r) all approach 0. Under these circumstances algorithms for the computation of y based on forward or backward recurrence are numerically unstable. Stable algorithms are based on approximating y(r) by the solutions of a certain sequence of boundary value problems which are shown to be equivalent to two initial value problems of order j and 1-j by factorization of the difference operator. The solution of the problem of order j is obtained by forward recurrence; the other solution is obtained by backward recurrence. GRA

N80-30128# National Geodetic Survey, Rockville, Md.
FEASIBILITY STUDY OF THE CONJUGATE GRADIENT METHOD FOR SOLVING LARGE SPARSE EQUATION SETS
Lothar Grundig Feb. 1980 27 p refs
(PB80-180235; NOAA-TR-NOS-82; NGS-13; NOAA-80032805) Avail: NTIS HC A03/MF A01 CSCL 12A

The effectiveness of various conjugate gradient methods for solving large sparse equation sets is analyzed. The use of conjugate gradient algorithms in geodetic surveys is considered. Some typical nets were used and compared with a direct solution algorithm. Results indicate that this method is well suited for constrained adjustments of triangulation networks, but not for free adjustments. No benefits were derived from preconditioning, which only increased the solution time. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-30129 American Univ., Washington, D. C.
TESTING THE EQUALITY OF THE MEANS OF TWO NORMAL DISTRIBUTIONS WHEN THE SAMPLES ARE TRUNCATED Ph.D. Thesis
Nancy Greene Berman 1980 91 p
Avail: Univ. Microfilms Order No. 8017446

Given a pair of random samples from normal populations that is truncated on the left a different points, the problem is to find a statistic for testing the null hypothesis that the underlying means of the two populations are equal, assuming the variances and truncation points are known. The likelihood ratio method was selected as proving the best test for this problem. The estimator for the mean of a single population is given as a rational polynomial approximation to the solution of the maximum likelihood equation. The estimator for the joint mean under the null hypothesis is approximated by a linear combination of the individual estimators weighted by the ratio of their variances. Both estimators are shown to be asymptotically normal and Monte Carlo procedures are used to determines the required sample size for convergence to normality for a range of truncation points. The asymptotic normality of the estimators led to consideration of an alternate test statistic derived from the usual normal theory, namely the difference of the sample estimators from each population. This statistic was shown by simulation to fit a standard normal distribution over the same range of values that were tested for the likelihood statistic. Dissert. Abstr.

N80-30130 Arizona State Coll. Flagstaff.
ROBUSTNESS OF MANOVA UNDER HETEROGENEITY OF VARIANCE AND CORRELATION Ph.D. Thesis
Robert Wayne Ceurvorst 1980 195 p
Avail: Univ. Microfilms Order No. 8017701

This Monte Carlo investigation was designed to unravel the effects of heterogeneity of variance and heterogeneity of correlation on Type 1 error rates in multivariate analysis of variance (MANOVA). Error rates of Roy's largest root, the Hotelling-Lawley trace, Pillai's trace, and Wilks' likelihood ratio and the power of Box's homoscedasticity criterion were examined in cases containing heterogeneity of variance and/or heterogeneity of correlation with two or three dependent variables, two, three, or six groups, and 18, 60, or 180 degrees of freedom for error (dfe). Error rates increased as the degree of heterogeneity and the number of groups increased and as dfe decreased. With two groups and 60 or more dfe, MANOVA was robust regardless of the degree of heterogeneity. Otherwise, MANOVA was most robust when correlations varied across groups but variances did not. When heterogeneity of variance was present, error rates were lowest when the groups with the largest variance had the largest correlation(s). Pillai's trace was generally the best criterion under all four types of heterogeneity and especially when all eigenvalues were larger in one population, which was generally the most serious type of heterogeneity as far as Type 1 errors are concerned. Dissert. Abstr.

N80-30131 Michigan Univ., Ann Arbor.
DESIGN EFFECTS FOR MULTIVARIATE CATEGORICAL INTERACTIONS Ph.D. Thesis
James Michael Lepkowski 1980 329 p
Avail: Univ. Microfilms Order No. 8017307

Two approaches to the examination of design effects of multivariate categorical interactions are developed. Analytic expressions for design effects in terms of simple random sample variances, subclass correlations, and design effects for proportions are given. The expressions are examined under a variety of assumptions about the values of the parameters that can be expected in practice, and models for the design effects of interaction measures are developed. Measures of cross homogeneity are proposed to explain the effects of covariation between characteristics across clusters on design effect for multivariate data. The second approach is an empirical examination of design effects for interaction measures for two survey data sets. Empirically, average design effects for the interaction statistic are less than average design effects of the proportions comprising the statistics and hence on the average closer to one. Average design effects for interaction statistics are different from one, often substantial homogeneities. Dissert. Abstr.

N80-30132 Florida State Univ., Tallahassee.
POPULATION DENSITY ESTIMATION USING LINE TRANSECT SAMPLING Ph.D. Thesis
John Anthony Ondrasik 1979 102 p
Avail: Univ. Microfilms Order No. 8016565

Density estimation techniques suitable for both inverse and combined sampling plans were developed. In H, both a parametric and a nonparametric estimate for the population density were

developed using the inverse sampling approach. It is shown that a primary advantage of estimation using inverse sampling is the fact that these estimates can be expressed as the product of two independent random variables. This representation not only enables us to obtain the expected value and variance of our estimates easily, but also leads to a simple criterion for sample size determination. A parametric density estimate that is suitable for the combined sampling method was also derived. This estimate is shown to be asymptotically unbiased. An approximation to the variance of this estimate was also calculated. The density estimates developed were based on the assumption that the sightings of animals are independent events. This assumption was relaxed and an estimation procedure was developed using inverse sampling that applied to clustered populations (those populations composed of small groups or clusters of objects).
Dissert. Abstr.

N80-30133 Carnegie-Mellon Univ., Pittsburgh, Pa.
ASYMPTOTIC DISTRIBUTIONS OF M-ESTIMATORS IN NON-STANDARD CASES Ph.D. Thesis
Gabriel Peter Pei 1980 93 p
Avail: Univ. Microfilms Order No. 8017458

An M estimator may be viewed as a functional, the location of a minimum, on the space of sample paths for a stochastic process over the parameter space. Under regularity conditions, the normalized process converge weakly to a nonstationary Gaussian process. The asymptotic distribution of the normalized M estimator is the distribution of this functional at the limiting stochastic process. When the usual regularity conditions hold, the sample paths of the limiting process are parabolas passing through the origin, each having the same second derivative. The M estimator is asymptotically normal with rate of convergence 1/sq rt of n. Nonstandard limiting behavior may occur if these conditions are violated. In certain problems the rate of convergence is found to be 1/sq root of (k log n) although the process remains parabolic. Faster rates of convergence occur in other examples where the limit sample paths are not parabolas. The resulting asymptotic distribution of the M estimator is nonnormal in these cases. A general theorem is given, which unifies these regular and nonregular results. Dissert. Abstr.

N80-30134 Kentucky Univ., Lexington.
OPTIMAL ALLOCATION OF RESOURCES TO REDUCE PRODUCT OR PROCESS VARIABILITY; A COMPARISON OF SOME DESIGNS TO ESTIMATE THE ALLOCATION PARAMETERS AND THE VARIANCE COMPONENTS Ph.D. Thesis
Jeffrey Howell Schwartz 1980 143 p
Avail: Univ. Microfilms Order No. 8018263

Assuming the variance to be reduced is the sum of variance components, optimal reduction entails optimally allocating a limited resource to reduce each component. Two specific variance reduction function (VFR) types, an exponential-type VRF and a step-type VRF, are defined. For both VRF types, the solution to the optimal allocation problem is obtained. The solutions are valid for an arbitrary number of variance components. To investigate the effect, on optimal reduction, of variance component estimation and experimental design, a three stage nested model is adopted and a simulation study carried out. The simulation, together with asymptotic results, is used to compare the designs with respect to variance component estimation. Tables of the mean variance, bias, and MSE of the estimates are presented. Asymptotic variance-covariance matrices are derived. Numerical values of the determinant, trace, and adjusted trace are calculated and tabulated. Equivalence of two formulations of asymptotic variance is demonstrated. An overall design comparison summary table, including asymptotic and simulation results, variance reduction and variance component estimation results, is presented. Dissert. Abstr.

N80-30135# Naval Research Lab., Washington, D. C.
PROPERTIES OF CROSS-ENTROPY MINIMIZATION Interim Report
J. E. Shore and R. W. Johnson 1 Apr. 1980 40 p refs
(RR0140941)
(AD-A085471; AD-E000431; NRL-MR-0941) Avail: NTIS HC A03/MF A01 CSCL 09/4

The principle of minimum cross-entropy (minimum directed divergence, minimum discrimination information) provides a general method of inference about an unknown probability density when there exists a prior estimate of the density and new information in the form of constraints on expected values. Previous work has shown that cross-entropy minimization can be characterized axiomatically by a small set of consistency axioms. Our purpose in this paper is to collect in one place and prove various fundamental properties of cross-entropy minimization. We include examples, and we discuss general analytic and computational methods of finding minimum cross-entropy probability densities. An interesting aspect of the results presented in this paper is the interplay between properties of cross-entropy minimization as an inference procedure and properties of cross-entropy as an information measure. Cross-entropy's well-known and unique properties as an information measure in the case of arbitrary probability densities are extended and strengthened when one of the densities involved is the result of cross-entropy minimization. For example, cross-entropy does not in general satisfy a triangle relation involving three arbitrary probability densities. But in certain important cases involving densities that result from cross-entropy minimization, cross-entropy satisfies triangle inequalities and triangle equalities. GRA

N80-30136# Massachusetts Univ., Amherst. Lab. of Psychometric and Evaluative Research.
BAYESIAN ESTIMATION IN THE ONE PARAMETER LATENT TRAIT MODEL
Hariharan Swaminathan and Janice A. Gifford Mar. 1980 52 p refs
(Contract N00014-79-C-0039; NR Proj. 150-427)
(AD-A085993; LR-106; RR-80-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

When several parameters are to be estimated simultaneously, and when both structural and incidental parameters have to be estimated, a Bayesian solution to the estimation problem may be appropriate. This is the case in latent trait models, where the 'structural' parameters are item parameters, while the 'incidental parameters' are ability parameters since these increase without bound as the numbers of examinees is increased to provide stable estimates of the item parameters. Bayesian estimates for the parameters in the one-parameter latent trait model were obtained for two cases: (1) conditional estimation of ability (for those situations when items are previously calibrated), and (2) joint estimation of item and ability parameters. For each of the two cases, a simulation study was carried out to study the efficacy of the two Bayesian procedures described and to compare the Bayesian estimates with the comparable maximum likelihood estimates. GRA

N80-30137# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
STOCHASTIC SYSTEMS AND THE PROBLEM OF STATE SPACE REALIZATION
J. C. Willems and J. H. Vanschuppen Jun. 1979 35 p refs
Presented at NATO Advanced Study Inst. and AMS Summer Sem. in Applied Math. on Algebraic and Geometric Methods in Linear System Theory, Cambridge, Mass., 18-29 Jun. 1979 Submitted for publication
(MC-BW-108/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4.21

An exposition of an approach to the problem of stochastic realization theory is presented. The concept of splitting relations and splitting random variables is introduced. How one can construct all minimal splitters for Gaussian random vectors is shown in detail. The relevant definitions of (autonomous) stochastic dynamic systems, of stochastic realization theory, and of white noise representation, as they arise naturally in this context are then introduced. The case of Gaussian random processes is worked out in detail. An example, a zero mean stationary Gaussian process defined on a probability space, is examined, concentrating on state space realizations of the form $y(t)=f(x(t))$ with x a Markov process. Results show that there is no unique (up to linear equivalence) minimal realization of stochastic finite dimensional stationary Gaussian processes. Author (ESA)

N80-30138# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
APPROXIMATIONS FOR THE STEADY STATE PROBABILI-

TIES IN THE MULITISERVER M/G/c QUEUE
H. C. Tijms (Vrije Univ., Amsterdam), M. H. vanHoorn, and A. Federgruen Jul. 1979 28 p refs Submitted for publication
(MC-BW-109/79) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

For the multiserver queue with Poisson arrivals and general service times, various approximations for the steady state probabilities of the queue size are presented. These approximations are computed from numerically stable recursion schemes which can be easily applied in practice. Numerical experience reveals that the approximations are very accurate with errors typically below 5%. For the delay probability the various approximations result either in the widely used Erlang delay probability or in an approximation which improves in many cases the Erlang delay probability approximation. Author (ESA)

N80-30139# National Climatic Center, Asheville, N. C.
A NOTE ON A GAMMA DISTRIBUTION COMPUTER PROGRAM
Grady F. McKay, Danny C. Fulbright, and Grady F. McKay Mar. 1980 89 p refs
(PB80-184013; NOAA/TM/EDIS-28; NOAA-80041001) Avail: NTIS HC A05/MF A01 CSCL 12A

The computer program for the gamma (Pearson Type III) distribution function is described and its applicability is discussed. The FORTRAN 4 program for this function: (1) provides the analytic solution to a set of data; (2) gives the probabilities of exceeding or not exceeding arbitray amount; (3) indicates the amounts exceeded or not exceeded for arbitary probabilities; (4) provides options to use the biased or unbiased estimates of the maximum likelihood or Thom estimators or to use moment estimators; (5) provides options to provide confidence bands and intervals in tabular and/or graphical forms; and (6) provides for computer output to microfilm or drum and/or flatbed plotters. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-30140 Stanford Univ., Calif.
PLANNING WITH CONSTRAINTS Ph.D. Thesis
Mark Jeffrey Stefik 1980 242 p
Avail: Univ. Microfilms Order No. 8016868

A combination approach to problem solving, termed constraint posting, that uses constraints to make the interactions between subproblems explicit is introduced. It shows how constraints can be dynamically formulated and propagated during hierarchical planning, and used to coordinate the solutions of nearly independent subproblems. Using this technique, under-constrained subproblems are temporarily combined to form well constrained larger problems. Constraint posting achieves efficiency by substituting constraint propagation for computationally expensive backtracking. Dissert. Abstr.

N80-30141# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL EXIT PROBABILITIES AND DIFFERENTIAL GAMES Interim Report
Wendell H. Fleming and Chun-Ping Tsai (Oklahoma Univ., Norman) Jan. 1980 58 p refs
(Grants AF-AFOSR-3063-76; NSF 76-07261; AF Proj. 2304) (AD-A085931; AFOSR-80-0428TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The problem is to control the drift of a Markov diffusion process in such a way that the probability that the process exits from a given region D during a given finite time interval is minimum. An asymptotic formula for the minimum exit probability when the process is nearly deterministic is given. This formula involves the lower value of an associated differential game. It is related to a result of Ventsel and Freidlin for nearly deterministic, uncontrolled diffusions. GRA

N80-30142# Brown Univ., Providence, R. I. Center for Dynamical Systems.
PARAMETER ESTIMATION AND IDENTIFICATION FOR SYSTEMS WITH DELAYS Interim Report
H. T. Banks, J. A. Burns, and E. M. Cliff Nov. 1979 88 p refs Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; DAAG29-78-G-0125; NSF MCS-79-05774)
(AD-A085929; AFOSR-80-0403TR) Avail: NTIS HC A05/MF A01 CSCL 12/2

Parameter identification problems for delay systems motivated by examples from aerodynamics and biochemistry are considered. The problem of estimation of the delays is included. Using approximation results from semigroup theory, a class of theoretical approximation schemes is developed and two specific cases ('averaging' and 'spline' methods) are shown to be included in this treatment. Convergence results, error estimates, and a sample of numerical findings are given. GRA

N80-30143# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE GAUSS-MARKOV APPROXIMATION SCHEME FOR IDENTIFICATION OF MULTIVARIABLE DYNAMIC SYSTEMS THROUGH REALIZATION THEORY: AN EXPLICIT APPROACH
A. K. Hajdasinski (Central Mining and Designing Office) Aug. 1979 108 p refs Sponsored in part by Stichting voo Zuiver Wetenschappelijk Onderzoek (ZWO)
(TH-78-E-88; ISBN-90-6144-088-2) Avail: NTIS HC A06/MF A01

How dynamic, linear, time invariant systems can be described in terms of the Hankel representation (H model). The H model and Markov parameters description of a system is then considered. Results of digital simulations are examined showing minimal variances in the Markov parameters as compared to a least squares estimation and an estimation using a sample covariance matrix. The use of the Ho-Kalman algorithm, based on a pseduo-inversion and singular valve decomposition method, to filter noisy Markov parameters is also explained. Author (ESA)

N80-30144# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE GLOBAL ERROR APPROACH TO THE CONVERGENCE OF CLOSED LOOP IDENTIFICATION, SELF TUNING REGULATORS, AND OF SELF TUNING PREDICTORS
A. Niederlinski (Politechnic Slaska, Poland) Sep. 1978 37 p refs
(TH-78-E-89; ISBN-90-6144-089-0) Avail: NTIS HC A03/MF A01

The global error is the identification error expressed as a function of unknown system parameters, model parameters, and external system inputs. It provides a convenient tool to test mean-square convergence for a number of complicated estimation problems. It is shown, how the global error approach can be used to give a simple explanation of well-known closed loop system models is shown. A self tuning regulation is analyzed for the general case of a difference equation model. A stationary time series to be predicted N-steps ahead is described and a unique solution for the predictor parameters is found which correspond to the optimum prediction parameters. Author (ESA)

N80-30145# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
CHARACTERIZING PROPERTIES OF THE VALUE FUNCTION FOR STOCHASTIC GAMES
S. H. Tijs (Catholic Univ., Nijmegen, Netherlands) and O. J. Vrieze Jul. 1979 19 p refs Submitted for publication
(MC-BW-110/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The axiomatic characterization of the value function of two-person zero-sum games in normal form is extended to dynamic games. Special attention is given to the value function of discounted two-person zero-sum stochastic games. Furthermore, value functions for stochastic games with arbitrary evaluation rules and general state as well as action spaces are examined. The characterizing axioms are indicated by the terms objectivity, monotony, and sufficiency (or symmetry) for both players. The concept of a superfluous action is used for a player in a state of the game. Such an action can be ignored by a player without

his being punished, since the value of the game remains invariant. It is also shown that the characterizing axioms are mutually independent. Author (ESA)

N80-30146# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
COMPLEXITY OF VEHICLE ROUTING AND SCHEDULING PROBLEMS
J. K. Lenstra and A. H. G. Rinnooy-Kan (Erasmus Univ.) Aug. 1979 14 p refs Submitted for publication
(Grant NSF MCS-76-17605)
(MC-BW-111/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The complexity of a class of vehicle routing and scheduling problems is investigated. Known NP-hardness results are reviewed and results on the worst case performance of fast approximation algorithms to solve this class of problems are compiled. It is demonstrated that almost all vehicle routing and scheduling problems are NP-hard and hence unlikely to be solvable in polynomial time. Nevertheless considerable differences in complexity within the class of NP-hard problems is evident. Further developments on the interface of mathematical programming and complexity theory are suggested as promising. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-30147# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
FACTORIZATION INDICES AT INFINITY FOR RATIONAL MATRIX FUNCTIONS
P. A. Fuhrmann (Ben Gurion Univ. of the Negev) and J. C. Willems (Mathematics Inst., Groningen, Netherlands) Sep. 1979 17 p refs Submitted for publication
(MC-BW-113/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The Wiener Hopf factorizations at infinity of a transfer function are studied. Then, the corresponding factorization indices are related to the reachability indices of a feedback equivalent, feedback irreducible system. Results are used to point out some interesting relations between the factorization indices of operator theory. By using purely algebraic methods the analysis is carried over an arbitrary field. Given a strictly proper rational matrix function G, a minimal realization Sigma=(A,B,C,) of G is constructed. The reachability indices of (A,B) with the left factorization of G are identified. The factorization indices of G itself are associated with the reachability indices of an associated feedback irreducible system feedback equivalent to G.
Author (ESA)

N80-30148# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NEWMAN-PENROSE TYPE FORMALISM FOR SPACE-TIMES WITH TORSION
S. Jogia and J. B. Griffiths Jun. 1979 30 p refs Sponsored in part by United Kingdom Scientific Research Council
(Math-Res-140) Avail: NTIS HC A03/MF A01

The Newman-Penrose formalism, in which the curvature of space-time is represented in terms of spin coefficients, is extended to include the possibility of an asymmetric connection. No particular equations of motion are assumed. In accordance with the spin coefficient approach these are included only in applications. The full set of equations extending over the Ricci identities, the contortion identities, and the Bianchi identities are given. The formalism presented is therefore applicable to all theories which consider the Riemann-Cartan space-time U sub 4, such as certain problems in Einstein-Cartan theory and other theories of gravitation that include torsion. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-30149 New York Univ., N. Y.
SPIN PRECESSION IN A HOMOGENEOUS GRAVITATIONAL FIELD Ph.D. Thesis
George K. Klein 1980 100 p
Avail: Univ. Microfilms Order No. 8017567

A basic framework is presented for the study of a stationary beam of particles falling in a homogeneous gravitational field, which is also consistent with the Theory of Relativity. A geometrical approach for the homogeneous gravitational field is given, emphasizing its main physical features, and in accordance with relativity in which this field is interpreted as the field apparently experienced by a uniformly accelerated observer (Born-Motion). The stationary beam of particles is studied in both the nonrelativistic approximation, and the relativistic. The so-called 'Quasi-Thomas' precession of the spin of the particle in a homogeneous gravitational field is calculated. The differences with the regular Thomas precession are discussed and illustrated with space-time diagrams. Some numerical estimates are given. The beam is then studied in the wave picture for Dirac particles. The precession of the spin obtained, agrees with the result given by the particle picture. The translationary motion is discussed as well as the problem of a homogeneous electric field. Dissert. Abstr.

N80-30150# Materials Research Labs., Melbourne (Australia).
A 10 MEGANEWTON (1000 tonf) FORCE STANDARD
E. Raymond Harrison and Frederick J. Brown Mar. 1980 14 p refs
(MRL-R-768; AR-002-418) Avail: NTIS HC A02/MF A01

Calibration of a force-testing machine allows it to be used as a 10-MN force standard for the testing of elastic-force calibrating devices to an accuracy of 0.2 per cent, this limitation being caused by friction of the machine's ram. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-30151 Columbia Univ., New York.
NOISE TRANSMISSION THROUGH STIFFENED PANELS Ph.D. Thesis
Mario Slazak 1980 103 p
Avail: Univ. Microfilms Order No. 8017472

An analytical study is presented to predict low frequency noise transmission through stiffened panels into cavity backed enclosures. Noise transmission is determined by solving the acoustic wave equation for the interior noise field and stiffened panel equations for vibrations of the stiffened panel. The dynamic behavior of the panel is determined by the transfer matrix procedure. Also presented is a transfer matrix development for stiffened sandwich panels. Results include comparisons between theory and experiment, noise transmission due to boundary layer turbulence, and noise transmission through the sidewall of an aircraft. Dissert. Abstr.

N80-30152 Stanford Univ., Calif.
TRANSMITTED SOUND FIELD DUE TO AN IMPULSIVE LINE ACOUSTIC SOURCE BOUNDED BY A RIGID PLATE FOLLOWED BY A VORTEX SHEET Ph.D. Thesis
Toshiki Miura 1980 85 p
Avail: Univ. Microfilms Order No. 8016849

The transmitted sound field is composed of two waves in both the steady-state and initial value problems. One is the wave scattered from the edge of the plate which is associated with the bow wave and the instability wave. These bow waves and instability waves exist in the downstream sectors. The other is the wave transmitted through the vortex sheet which is also associated with the instability wave. This instability wave exists

in a downstream sector, but if the line source is close to the rigid plate it is blocked by the plate and does not appear. The transmitted sound field can be divided into three regions. The first one is the region where the incident wave is shaded by the plate and only the waves scattered from the plate edge exist. In the second region there exist the waves transmitted through the vortex sheet in addition to the scattered waves from the edge of the plate. The third region is the transition region between the two regions just described. In this region the waves transmitted through the vortex sheet can be heard partially depending on its wave number. The asymptotic nature of this region is the same as that of the second region.

Dissert. Abstr.

N80-30153 Stanford Univ., Calif.
ACOUSTIC IMAGING WITH GRATING ACOUSTIC SCANNERS Ph.D. Thesis
Wen-Hsien Chen 1980 229 p
Avail: Univ. Microfilms Order No. 8016813

The development and application of grating acoustic scanners (GAS) are described, which employ scattering of either a surface acoustic wave (SAW) or a longitudinal acoustic wave from a mechanical grating to produce a focused and scanned beam of longitudinal bulk acoustic wave. To evaluate the performance of the SAW GAS, three scanners with operating frequencies at 2.3 MHz, 3.3 MHz, and 100 MHz were built and tested. A modified grating acoustic scanner using bulk acoustic waves instead of surface acoustic waves is also studied. Two features of these devices not available with other types of electronically scanned devices are: (1) extreme simplicity in construction and operations, and (2) scalability to very high frequencies, with corresponding very high resolution. They can be operated in the frequency range of a few MHz for nondestructive testing or nondestructive evaluation of materials and medical diagnosis applications. They may also be operated in the frequency range of a few GHz for acoustic microscopy applications. A scheme for electronically steering an acoustic beam over an angle greater than 70 deg in a tellurium dioxide crystal is presented.

Dissert. Abstr.

N80-30154*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL TECHNIQUES IN LINEAR DUCT ACOUSTICS Status Report
K. J. Baumeister 1980 23 p refs Proposed for presentation at Winter Ann. Meeting of ASME Chicago, 17-21 Nov. 1980 (NASA-TM-81553; E-513) Avail: NTIS HC A02/MF A01 CSCL 20A

Both finite difference and finite element analyses of small amplitude (linear) sound propagation in straight and variable area ducts with flow, as might be found in a typical turbojject engine duct, muffler, or industrial ventilation system, are reviewed. Both steady state and transient theories are discussed. Emphasis is placed on the advantages and limitations associated with the various numerical techniques. Examples of practical problems are given for which the numerical techniques have been applied. A.R.H.

N80-30155*# Boeing Commercial Airplane Co., Seattle, Wash.
ANALYTICAL INVESTIGATION OF FAN TONE NOISE DUE TO INGESTED ATMOSPHERIC TURBULENCE Final Report
Ulrich W. Ganz Washington, D.C. NASA Aug. 1980 151 p refs
(Contract NAS1-15085)
(NASA-CR-3302) Avail: NTIS HC A08/MF A01 CSCL 20A

The atmospheric turbulence involved in the fan noise generation is evaluated with an existing model for the atmospheric turbulence and an extended version of an existing model concerned with the effects of a flow contraction on convected turbulence. Fan tone noise due to ingested atmospheric turbulence is evaluated with existing fan noise models. The results indicate that the difference in fan narrowband noise due to atmospheric turbulence between static and flight landing approach conditions is in the order of 30 dB. It is concluded that fan noise due to atmospheric turbulence is insignificant in flight conditions for the fans used in the current high bypass ratio engines. The difference in fan narrowband noise between the two conditions is primarily due to the low intensity of the turbulence involved in fan noise generation in flight conditions. Fan noise due to atmospheric turbulence in static conditions should be reduced below the flight fan broadband noise levels which is best achieved with a reduction in the intensity of the fan inflow turbulence. Such a reduction can be obtained with the use of an inflow control device, low wind velocities, small surface roughness in the test stand environment, and large engine axis height above the ground. Peak sound power levels for fan tone noise due to ingested turbulence occur for transverse integral scales in the order of 25% of the rotor blade spacing in the fan tip region. Author

N80-30158# Federal Aviation Administration, Washington, D. C. Office of Environment and Energy.
INM INTEGRATED NOISE MODEL, VERSION 2: PROGRAMMER'S GUIDE
Thomas Connor and Robert Hinckley Sep. 1979 130 p Supersedes FAA-EQ-78-03
(Contract DOT-PPA-FA-865)
(AD-A079622; FAA-AEE-79-10; FAA-EQ-78-03) Avail: NTIS HC A07/MF A01 CSCL 20/1

This document contains information on the procedures to implement the Integrated Noise Model (INM), Version 2 into a computer system. The INM is a collection of computer programs which can calculate the aircraft noise environment in the vicinity of an airport. The INM is available from the FAA in the form of a magnetic tape. INM Version 2 supersedes Version 1 which was released in January 1978. This document replaces FAA Integrated Noise Model, Version 1, Computer Installation Instructions: (Report No. FAA-EQ-78-03). GRA

N80-30157# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 4: TONE PERCEPTION Final Report
D. N. May and E. E. Watson Feb. 1980 75 p refs
(Contract DOT-FA78WA-4143)
(AD-A083075; WR-79-9-Vol-4; FAA-EE-80-1-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 20/1

The existing tone correction procedure in the Effective Perceived Noise Level (EPNL) calculation procedure required for aircraft certification under Part 36 of the Federal Aviation Regulations was compared with other tone correction procedures, including the SAE Aerospace Recommended Practice 1071 and a multitone procedure due to Krytar and Pearsons. Different amounts of tone correction (level-weightings) and varying degrees of tone correction at different times in the flyover (time-weightings) were also explored. Also studied was a measure of spectral fluctuation, developed by NASA and known as spectral change. The research was limited to considering revisions within the framework of one-third octave, 0.5 second interval analysis, since such revisions can be quite easily implemented. The various tone correction noise metrics were tested against subjective judgements furnished by NASA of the noise from a range of propjet, turbojet, low and high bypass ratio turbofan, and supersonic commercial aircraft. It was found that a revision based on spectral change could, after further development, be a means to improve the accuracy of the EPNL metric. However, the success of the various other potential revisions depended on the characteristics of the data base tested. It was shown that research into improved metrics should be based on experimental plans which account for the correlations among the noise variables and the presence of any interactions. A separate, psychoacoustical pilot experiment was also performed into the effects of pseudotones on judged noisiness. (Pseudotones are low frequency tones introduced into a measured spectrum by ground reflections near the microphone. GRA

N80-30158# Pennsylvania State Univ., University Park. Applied Research Lab.
ACOUSTICAL SCATTERING FROM THE IMPEDANCE COVERED STRAIGHT EDGE AND WEDGE, THE EXACT THEORY
E. J. Skudrzyk Jan. 1975 187 p refs
(Contract N00017-73-C-1418)
(AD-A086003; ARL/PSU/TM-75-01) Avail: NTIS HC A09/MF A01 CSCL 20/1

The analytic extension of the Fourier integral from the half space to wedge-like spaces leads to Sommerfeld type integrals.

Theorems derived by Malyuzhinets in conjunction with new methods of handling Fourier Laplace integrals make it possible to apply the boundary conditions to the integrand to determine the integrand function and thus to determine the solution from the boundary conditions. The resulting Malyuzhinets functions can then be closely approximated by simple expressions for real and complex arguments. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-30158 California Univ., Davis.
THEORY OF ATOMIC MOTION IN RESONANT RADIATION Ph.D. Thesis
Richard Joseph Cook 1979 135 p
Avail: Univ. Microfilms Order No. 8011745

The Schroedinger equation for atomic motion in a resonant standing wave was solved in the limit of short atom-field interaction time. It is shown that momentum transfer from the field to the atom in a standing wave proceeds at the rate of induced absorption emission processes rather than at the spontaneous rate characteristic of momentum transfer in a plane running wave. It is shown that a narrow beam of two level atoms is split by the amplitude gradient of a resonant electromagnetic wave (optical Stern Gerlach effect). The influence on atomic motion of quantum mechanical fluctuations of the radiation force is investigated. It is shown that fluctuations of the radiation force result from interaction of the fluctuating atomic dipole moment with the applied field as well as from random recoils accompanying spontaneous emission. Atomic motion in the fluctuating radiation force is described by a Fokker Planck equation, and this equation is used to show that quantum fluctuations place a lower bound on the temperature achievable by radiation cooling, and lead to finite, often short, confinement times for atoms in radiation traps. Dissert. Abstr.

N80-30160 Yale Univ., New Haven, Conn.
THEORY OF LONG RANGE INTERATOMIC FORCES Ph.D. Thesis
Peter Robert Fontana 1980 118 p
Avail: Univ. Microfilms Order No. 8018249

General methods for calculating the electrostatic interaction energies between atoms in ground and excited states suggested by the theory of angular momentum are investigated. In developing these, the effects of spin-orbit coupling on the interaction energies are included. The classical interaction energy between two atoms is written as a contraction of irreducible tensors which permits the calculation of the general term for any multipole order. The formalism is first applied to the interaction of noble gas and alkali atoms in their ground states. The theory is then extended to describe the interaction of alkali atoms in arbitrary excited states. The use of a coupled representation is valid only as long as the electrostatic interaction is a true perturbation on the system. To investigate the transition from a representation in which spin effects are neglected to the one which includes the spin-orbit coupling correctly, a more general perturbation method is formulated. Attention is also given to the interaction energies between an alkali atom in the first excited and another one in a higher excited state. Dissert. Abstr.

N80-30161 Rice Univ., Houston, Tex.
COLLISIONAL PHENOMENA BETWEEN ELECTRONS AND HIGH RYDBERG ATOMS Ph.D. Thesis
Greg William Foltz 1980 220 p
Avail: Univ. Microfilms Order No. 8018052

A fraction of the atoms in a ground state sodium beam was optically excited (using lasers) to well defined, high Rydberg states (principal quantum numbers chosen around 40). Subsequent to their production the Rydberg atoms were allowed to interact with 25 eV electrons for a specified time interval following which the collision products were detected. The electrons are produced in a beam which is crossed at right angles with the sodium beam. Important collision processes are electron impact ionization of the Rydberg atom, and electron Rydberg atom interactions in which the quantum state of the atom is changed (state changing collisions). Results are presented for an observed state changing process which is identified as angular momentum state changing only (no change in the value of the principal quantum number). Problems which prevented the measurement of electron impact ionization cross sections are discussed. Results from studies of the process of electric field ionization to Rydberg atoms (used to detect the atoms), and the effects of background (300 K) radiation (from the chamber walls, for example) on Rydberg atoms are included. Dissert. Abstr.

N80-30162*# Xavier Univ. of Louisiana, New Orleans.
THE MULTISTATE IMPACT PARAMETER METHOD FOR MOLECULAR CHARGE EXCHANGE IN NITROGEN Final Report
Juliette W. Ioup Washington, D.C. Aug. 1980 33 p refs
(Grant NsG-1361)
(NASA-CR-3307) *Avail:* NTIS HC A03/MF A01 CSCL 20H

The multistate impact parameter method is applied to the calculation of total cross sections for low energy charge transfer between nitrogen ions and nitrogen molecules. Experimental data showing the relationships between total cross section and ion energy for various pressures and electron ionization energies were obtained. Calculated and experimental cross section values from the work are compared with the experimental and theoretical results of other investigators. E.D.K.

N80-30163# Georgia Univ., Athens.
STUDY OF MATTER CURRENT EFFECTS IN TWO-BODY INELASTIC COLLISIONS M.S. Thesis
M. K. Rulison 1979 70 p refs
(Contracts DE-AS09-76ER-00946; EY-76-S-09-0946)
(DOE/ER-00946/4) Avail: NTIS HC A04/MF A01

The proposed experimental test of the matter current idea consists of determining the spin rotation parameter, R, in polarized elastic meson-proton scatterings. The measurement of R usually requires a second scattering of the recoil proton off a known analyzer such as C. The purpose of this work is to offer another method by which the hadronic matter current effect can be detected. Instead of elastic scattering, the two-body inelastic scattering process in which the final state hyperon is unstable against weak decay is considered. By observing the angular distribution of the decay products the rotation parameter, R, may be inferred. DOE

N80-30164# Oak Ridge National Lab., Tenn.
HOLLOW CATHODE FOR POSITIVE ION SOURCES
D. E. Schechter, J. Kim, and C. C. Tsai 1979 11 p refs
Presented at the 8th Symp. of Eng. Probl. of Fusion Res., San Francisco, 10 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791102-152) Avail: NTIS HC A02/MF A01

Development to incorporate hollow cathodes into high power ion sources for neutral beam injection systems is being pursued. Hollow tube LaB6 type cathodes were constructed and tested in several ion source configurations. Results of testing include arc discharge parameters of > 1000 and 500 amps for 0.5 and 10 second pulse lengths, respectively. Details of cathode construction and additional performance results are discussed. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see 93 Space Radiation.

N80-30165 Maryland Univ., College Park.
NONLINEAR ELECTROSTATIC ION CYCLOTRON WAVES Ph.D. Thesis
James Richard Myra 1979 118 p
Avail: Univ. Microfilms Order No. 8016986

The nonlinear physics associated with finite amplitude,

coherent, electrostatic ion cyclotron waves is studied analytically. A perturbation scheme is utilized to derive the lowest order nonlinear corrections to the linear wave. To determine the effect of the nonlinear particle orbits on the ion cyclotron wave, the Vlasov equation for the ions is solved to third order in the wave amplitude. A nonlinear equation for the propagation of a wave packet in a stable plasma is derived and the slowly varying modulation envelope of the wave is shown to obey a nonlinear Schrodinger equation when the frequency of the wave is sufficiently close to a multiple of the cyclotron frequency. The dominant nonlinearity is then related to a nonlinear shift in the effective gyrofrequency of the ions. For ion cyclotron waves modulated along the field lines and in time, analysis reveals an additional smaller nonlinearity arising from the parallel ponderomotive force on the ions. The case of an unstable plasma, with coherent cyclotron waves driven by the free energy of a cold ion beam directed along the magnetic field, is also considered. The nonlinear frequency shift is shown to be the dominant stabilization mechanism acting on a short time scale when the beam energy density is large compared to the thermal energy density of the background plasma. Dissert. Abstr.

N80-30166# Naval Research Lab., Washington, D. C. Plasma Physics Div.

COLLECTIVE ACCELERATION WITH ROTATING RELATIVISTIC ELECTRON BEAMS

D. N. Spector, K. A. Gerber, R. A. Mahaffey (Sachs/Freeman Assoc., Inc., Bladensburg, Md.), R. A. Mager (JAYCOR, Alexandria, Va.), and J. D. Sethian 11 Apr. 1980 14 p refs

(RR0110941)

(AD-A085475; AD-E000429; NRL-MR-4151) Avail: NTIS HC A02/MF A01 CSCL 20/9

Observation of accelerated protons during the injection of rotating relativistic electron beams into neutral hydrogen (50 mTorr to 400 mTorr) indicated that ions from the beam-formed plasma are trapped and accelerated by a potential well at the beamfront. Measurements show that the number of accelerated protons decreases as the beamfront velocity is increased. Moreover, at a given velocity, the number accelerated is relatively insensitive to the neutral gas pressure. GRA

N80-30167# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.

COLLECTIVE ION ACCELERATION Final Report, 15 Jan. 1975 - 14 Jan. 1980

John A. Nation 1980 198 p refs

(Contract F44620-75-C-0054; AF Proj. 2301)

(AD-A085312; AFOSR-80-0440TR) Avail: NTIS HC A09/MF A01 CSCL 20/7

Work was conducted on the excitation of slow cyclotron and slow space charge waves in a plasma beam. Observations were made when a planar electron beam was propagated through a strip line. The beam was guided by a homogeneous magnetic field and the excitation achieved with a zero frequency pump wave. Both the space charge and cyclotron waves were excited in the 20-30 GHz interaction and the cyclotron wave in the 70 GHz range. For the first time, independent measurements were made of the effects on growth rate of the homogeneous guide field and the rippled field. Experiments were conducted on the proof-of-principle for a space charge wave accelerator. A large amplitude space charge wave was grown on an electron beam. Phase velocities of 0.25 c, and accelerating fields of 60kV/cm were obtained. GRA

N80-30168# Los Alamos Scientific Lab., N. Mex.

USDOE RADIOACTIVE WASTE INCINERATION TECHNOLOGY: STATUS REVIEW

Leon C. Borduin and Anibal L. Taboas (DOE, Albuquerque, N. Mex.) 1980 40 p refs Presented at the 2d DOE Environ. Control Symp., Reston, Va., 17 Mar. 1980

(Contract W-7405-eng-36)

(LA-UR-80-692; CONF-800334-5) Avail: NTIS HC A03/MF A01

An introduction to incineration concerns and an overview of the prominent radwaste incineration processes being developed within DOE are presented. Brief process descripitions, status and goals of individual incineration systems, and planned or potential applications are also included. Development efforts continue and significant results are available for the nuclear community and the general public to draw on in planning. DOE

N80-30169# URS/Blume (John A.) and Associates, San Francisco, Calif.

CONSIDERATIONS FOR DEVELOPING SEISMIC DESIGN CRITERIA FOR NUCLEAR WASTE STORAGE REPOSITORIES

G. Norman Owen, Peter I. Yanev, and Roger E. Scholl Apr. 1980 69 p refs

(Contract DE-AC08-76DP-00099)

(JAB-00099-128) Avail: NTIS HC A04/MF A01

The development of seismic design criteria for the underground structures of repositories is addressed. An initial step in the development of seismic design criteria for the underground structures of repositories is the development of performance criteria, or minimum standards of acceptable behavior. A number of possible damage modes are identified for the operating phase of the repository; however, no damage modes are foreseen that would perturb the long-term function of the repository, except for the possibility of increased permeability within the rock mass. Subsequent steps in formulating acceptable seismic design criteria for the underground structures involve the quantification of the design process. The necessity of specifying the form of ground motion that would be needed for seismic analysis and the procedures that may be used for making ground motion predictions are discussed. Further, analytic concerns including rock properties, failure criteria, modeling techniques, seismic hardening criteria for the host rock mass, and probabilistic considerations are examined. DOE

N80-30170# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.

HIGH LEVEL NUCLEAR WASTE

J. L. Crandall 1980 40 p Presented at the 17th Ann. Symp. of the Am. Soc. of Mech. Engr., Idaho Falls, Idaho, 29 May 1980

(Contract DE-AC09-76SR-00001)

(DP-MS-80-39; CONF-800535-1) Avail: NTIS HC A03/MF A01

The DOE Division of Waste Products through a lead office at Savannah River is developing a program to immobilize all US high-level nuclear waste for terminal disposal. DOE high-level wastes include those at the Hanford Plant, the Idaho Chemical Processing Plant, and the Savannah River Plant. Commercial high-level wastes, for which DOE is also developing immobilization technology, include those at the Nuclear Fuel Services Plant and any future commercial fuels reprocessing plants. The first immobilization plant is to be the Defense Waste Processing Facility at Savannah River, scheduled for 1983 project submission to Congress and 1989 operation. Waste forms are still being selected for this plant. Borosilicate glass is currently the reference form, but alternate candidates include concretes, calcines, other glasses, ceramics, and matrix forms. DOE

N80-30171# Oak Ridge National Lab., Tenn.

OVERVIEW OF NUCLEAR FUEL CYCLE

J. O. Blomeke 1979 32 p Presented at the ANS Student Chapter Seminar, College Station, Texas, 5-9 Nov. 1979

(Contract W-7405-eng-26)

(CONF-791185-3) Avail: NTIS HC A03/MF A01

A broad, general look is given at the fuel cycle from an overall perspective. Covered are: boiling water reactors and pressurized water reactors fuel characteristics, U mining and milling, enrichment, fuel fabrication, spent fuel reprocessing, handling and shipment, etc. Results of the International Fuel Cycle Evaluation are summarized. DOE

N80-30172# Oak Ridge National Lab., Tenn.

DISPOSAL OF RADIOACTIVE WASTES

J. O. Blomeke 1979 38 p Presented at ANS Student Chapter Seminar, College Station, Tex., 5-9 Nov. 1979

(Contract W-7405-eng-26)

(CONF-791185-2) Avail: NTIS HC A03/MF A01

Radioactive waste management and available disposal requirements options are discussed. The possibility of beneficial utilization of radioactive wastes is covered. Methods of interim storage of transuranium wastes are listed. Methods of shipment of low level and high level radioactive wastes are presented.

Various methods of radioactive waste disposal are discussed.
DOE

N80-30173# Union Carbide Corp., Oak Ridge, Tenn. Engineering Div.
MANAGEMENT OF SOLID WASTE
W. T. Thompson and L. H. Stinton 16 Apr. 1980 21 p
(Contract W-7405-eng-26)
(ORNL/ENG/INF-80/1: CONF-800416-2) Avail: NTIS HC A02/MF A01

Compliance with the latest regulatory requirements addressing disposal of radioactive, hazardous, and sanitary solid waste criteria in the selection, design, and operation of solid waste management facilities. Due to the state of flux of these regulatory requirements from EPA and NRC, several waste management options were of solid waste. The current regulatory constraints and the design and operational requirements for construction of both storage and disposal facilities for use in management of DOE-ORO solid waste are highlighted. Capital operational costs are included for both disposal and storage options. DOE

N80-30174# Gilbert/Commonwealth, Reading, Pa.
STATE OF THE ART REVIEW OF RADIOACTIVE WASTE VOLUME REDUCTION TECHNIQUES FOR COMMERCIAL NUCLEAR POWER PLANTS
Apr. 1980 256 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-79/13837/2) Avail: NTIS HC A12/MF A01

The state of the art of volume reduction techniques is reviewed for low level liquid and solid radioactive wastes produced as a result of: (1) operation of commercial nuclear power plants, (2) storage of spent fuel in away-from-reactor facilities, and (3) decontamination/decommissioning of commercial nuclear power plants. The types of wastes and their chemical, physical, and radiological characteristics are identified. Methods used by industry for processing radioactive wastes are reviewed and compared to the new techniques for processing and reducing the volume of radioactive wastes. A detailed system description and report on operating experiences follow for each of the new volume reduction techniques. In addition, descriptions of volume reduction methods presently under development are provided.
DOE

N80-30175# Department of Energy, Washington, D. C.
SPENT FUEL SHORTAGE: FACTS BOOKLET
Apr. 1980 66 p refs
(DOE/NE-0005) Avail: NTIS HC A04/MF A01

In October 1977, the Department of Energy (DOE) announced a spent nuclear fuel policy where the Government would, under certain conditions, take title of and store spent nuclear fuel from commercial power reactors. The policy is intended to provide spent fuel storage until final disposition is available. The DOE has programs for providing safe, long-term disposal of nuclear waste. The spent fuel storage program is one element of waste management and compliments the disposal program. The costs for spent fuel services are to be fully recovered by the Government from the utilities. This will allow the utilities to confidently consider the costs for disposition of spent fuel in their rate structure. The United States would also store limited amounts of foreign spent fuel to meet nonproliferation objectives. This booklet summarizes information on many aspects of spent fuel storage.
DOE

74 OPTICS

Includes light phenomena.

N80-30176 Carnegie-Mellon Univ., Pittsburgh, Pa.
COHERENT OPTICAL PROCESSING OF PASSIVE SIGNALS Ph.D. Thesis
Bhagavatula Venkata Krishna VijayaKumar 1980 245 p
Avail: Univ. Microfilms Order No. 8017456

The dynamic range, resolution and nonlinear response of the data planes in an optical processor affect the performance of an optical correlator. These system issues are addressed for the passive signal processing problem assuming random variable signals. It is shown that quantization is of no concern for random signal and a new parameter, space blur bandwidth product is introduced to describe resolution effects. A unified discussion of how optical processors can operate on the complex valued data typical of several passive signal estimation applications is also included. Two passive signal processing applications (adaptive phased array radar and passive ambiguity surface generation for sonar) are then described. Two coherent optical processing systems for these applications are presented, experimental data are included, and a statistical analysis of the results in systems is provided. Dissert. Abstr.

N80-30177 Arizona Univ., Tucson.
SIMULATION OF SPECTRAL RADIANCE OF A DYNAMIC INFRARED SOURCE Ph.D Thesis
Marija Strojnik Scholl 1980 310 p
Avail: Univ. Microfilms Order No. 8017768

An infrared source with spatially and temporally variable radiance is designed. It can be to simulate any other infrared source simultaneously in two wavelenght bands. The theoretical analysis of the real and simulator source is performed to define the design parameters. A series of the concepts are evaluated for their potential as in infrared sources. A three dimensional heat transfer computer program is used to predict the thermal behavior of the prototype glassy carbon waffle target. Tests are performed on this target on this target which shown that its thermal and radiation properties are in agreement with its predicted behavior. Glassy carbon waffle source is a good infrared radiotor which can be used repeatedly at high temperatures. Measurements are described which show that the uniformity in the surface temperature can be maintained even when a scanning laser beam is used to deposit the energy on the target surface. The target surface is described analytically as a low pass filter. Its time constant it shown on depend analytically as a low pass filter. Its time constant it shown to depend on the target material and the temperature distribution in the target. Dissert. Abstr.

N80-30178# Aerospace Corp., El Segundo, Calif. Astrophysics Lab.
INTERFERENCE PATTERNS PRODUCED BY A MACH-ZEHNDER INTERFEROMETER AND A MULTILINE HF LASER Interim Report
R. W. F. Gross, J. G. Coffer, E. B. Turner, R. A. Chodzko, and W. R. Warren, Jr. 10 Apr. 1980 22 p refs
(Contract F04701-79-C-0080; DARPA Order 3646)
(AD-A085409; TR-0080(5764)-2; SD-TR-80-17) Avail: NTIS HC A02/MF A01 CSCL 20/6

The fringe pattern produced by a Mach-Zehnder interferometer illuminated with the light from a hydrogen fluoride (HF) laser operating on a large number of laser lines was investigated. Emphasis was placed on the intensity variations of the infrared fringes that are observed when one element of the interferometer is translated, thereby changing the length of one optical path. An intensity maximum similar to 'white-light fringes' is observed when the two arms of the interferometer have equal optical lengths. The experimental results are compared with numerically predicted fringe patterns calculated from the spectral content of the illuminating laser beam. A method is suggested for actively controlling the phases of a number of parallel HF laser amplifiers in high-power phased-array devices. GRA

N80-30179# ITT Electro-Optical Products Div., Roanoke, Va. Products Div.
SINGLE-MODE BEND EVALUATIONS, ADDENDUM
G. Salisbury 15 May 1980 31 p
(Contract N00173-78-C-0196)
(AD-A085405; ITT-80-20-06-Add) Avail: NTIS HC A03/MF A01 CSCL 20/6

This test is designed to find the bend-induced losses of four fibers. Three of these fibers are of the high numerical aperture (NA) design, and one fiber is of the low NA design. GRA

N80-30180# University of Southern California, Los Angeles.
WAVEGUIDE STUDIES FOR FIBER OPTICS AND OPTICAL SIGNAL PROCESSING APPLICATIONS Final Technical Report, 11 Sep. 1977 - 10 Sep. 1979
Elsa Garmire Griffiss AFB, N.Y. RADC Apr. 1980 115 p refs

(Contract F19628-77-C-0221; AF Proj. 2306)
(AD-A086115; RADC-TR-80-82) Avail: NTIS HC A06/MF A01 CSCL 20/6

This report describes investigations of waveguide components for use in multimode fiber optics and in optical signal processing. Measurements of beam expansion and polarization properties of distributed Bragg deflectors are described. Measurements of the characteristics of DBR lasers are detailed, with emphasis on those properties which are relevant to their use as sources to couple to the waveguide beam expander. Studies of the mechanisms for loss in LiNbO3 waveguides are described and techniques to reduce the waveguide loss in LiNbO3 modulators are outlined. Finally, preliminary experiments on electro-thermal diffusion in LiNbO3 are described. GRA

N80-30181# Itek Corp., Lexington, Mass. Optical Systems Div.

HIGH BANDWIDTH, FINE RESOLUTION DEFORMABLE MIRROR DESIGN Final Report

Ralph E. Aldrich, Jeffrey H. Everson, and Nedo P. Albertinetti Kirtland AFB AFWL Mar. 1980 80 p
(Contract F29601-78-C-0060)
(AD-A086089; AD-E200495; ITEK-8432; AFWL-TR-79-5)
Avail: NTIS HC A05/MF A01 CSCL 20/6

This report describes the design, fabrication and testing of five candidate actuator types to achieve a deformable mirror capable of 6 microns dilatation at 1.5 kV. The actuator types are the coherent stack, bimorph, tube, multilayer and the honeycomb. GRA

N80-30182# Science Applications, Inc., La Jolla, Calif.

REAL-TIME APPLICATIONS OF OPTICAL SIGNAL PROCESSING TO COMMAND AND CONTROL COMMUNICATIONS Final Technical Report, Apr. 1978 - Sep. 1979

W. Stoner, E. Garber, F. Horrigan, G. Collins, and J. Phelps Griffiss AFB, N.Y. RADC Apr. 1980 56 p refs
(Contract F19628-78-C-0117; RZ512340)
(AD-A086081; RADC-TR-80-86) Avail: NTIS HC A04/MF A01 CSCL 20/6

The program reported on in this final report was directed towards development of real-time optical signal processing for C3 and radar applications. Specifically, these applications were A/D conversion, spread spectrum code acquisition and decoding, and clutter rejection in look-down radar. In the context of these applications and through discussions with RADC/ET, technical goals were framed, such as a goal of A/D conversion at 1 Ghz. New optical signal processing techniques were conceived to meet the technical goals. These new approaches include a noncoherent kaleidoscope system for A/D conversion, and a noncoherent optical correlation technique which accommodates the bipolar and complex-valued signals encountered in spread spectrum communications and in radar. During the course of our program, determinations were made of the specific hardware best suited for the testing and demonstration of these novel approaches. These determinations were made by theoretical calculations and by consulting with the literature. Experimental tests of many subsystems, such as the noncoherent correlator optics and acousto-optic Bragg cells for introducing signals into the correlator in real-time, were tested at RADC/ET. Investigations were also made of computer generated holograms for use as pupil masks in the noncoherent correlator. GRA

N80-30183# Itek Corp., Lexington, Mass. Optical Systems Div.

RESEARCH AND DESIGN OF A PROM COHERENT OPTICAL PROCESSOR Final Technical Report, 25 Sep. 1979 - 7 Mar. 1980

Francis J. Corbett, Richard A. Tuft, W. Faccenda, R. Copper, and A. Rux 10 Apr. 1980 51 p refs
(Contract DAAK70-79-C-0164)
(AD-A085992; ITEK-9565-62; ETL-0219) Avail: NTIS HC A04/MF A01 CSCL 17/8

This program produced a design for a coherent optical image processor utilizing a PROM(s). The PROM Coherent Optical Processor or PCOP is a subsystem of the USAETL Hybrid (Optical/Digital) Image Processor. The design and supporting analysis tasks are detailed in the report. The purpose of development of this processor is to evaluate automatic image feature extraction algorithms. The PCOP is a two PROM Fourier plane filter processor which operates in the following manner. The first PROM is the input image plane. Imagery is scaled through a lens system and then manipulated in intensity space at the input PROM. The image transform is taken next in the processing sequence and then filtered at the second PROM. Filters are generated with a laser optical scanner. The reconstructed image is produced on a charge integrating camera and displayed on a CRT. Image quality and data throughput were determined and the PCOP design was made to insure the output quality was compatible with the USAETL program objectives. GRA

N80-30184# Army Missile Command, Redstone Arsenal, Ala. Directed Energy Directorate.

A SIMPLE METHOD FOR TREATING DIFFRACTIVE PROPAGATION FROM A LASER WITH DIAGNOSTIC OPTICS

R. W. Jones, J. C. Nixon, and J. F. Perkins 19 Nov. 1979 14 p refs
(AD-A085871; DRSMI/RH-80-2) Avail: NTIS HC A02/MF A01 CSCL 20/3

The diffractive propagation of a complex laser beam through a multi-element optical system is considered. It is shown that the problem can be easily reduced to propagation of a quasi-collimated laser beam in free space through a distance d sub eff determined by successive applications of a simple lens equation. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-30185 Columbia Univ., New York.

A NUMERICAL STUDY OF THE INITIAL DYNAMICS IN TORMAC Ph.D. Thesis

Ahmet Y. Aydemir 1980 232 p
Avail: Univ. Microfilms Order No. 8016898

A single fluid magnetohydrodynamic (MHD) code was used to study the initial plasma dynamics in Tormac, an experimental device which attempts to confine plasma in a toroidal two pole cusp field. The code is in two dimensions and includes classical electrical conductivity and a constant heat conductivity. Results of the simulations indicate that the external fields in Tormac are such that, starting with some reasonable initial conditions, the plasma never reaches the desired equilibrium state. It initially forms two horn like structures attached to a main body of plasma, which help the plasma get further away from the desired configuration. Eventually, most of the plasma ends up near the inner wall, with a temperature in the range of 10 electron volts. To improve the plasma behavior, various changes in the initial conditions and boundary values were tried. Altering the boundary values led to improvements by eliminating some of the external currents and delaying in time of some of the others, it was possible to implode the plasma to a configuration very similar to the desired cusp equilibrium. However, after this initial phase, the plasma flows along the open poloidal field lines towards the cusp region, and the top and bottom walls of the device. The plasma is too cold, and thus too collisional, to support any pressure anisotropy necessary for such mirror confinement. Dissert. Abstr.

N80-30186 Columbia Univ., New York.

SPECTROSCOPIC STUDY OF TURBULENT HEATING IN THE HIGH BETA TOKAMAK TORUS 2 Ph.D. Thesis

George E. Georgiou 1980 143 p
Avail: Univ. Microfilms Order No. 8016952

Visible spectroscopy, involving line profile and line intensity measurements, was used to study the turbulent heating of the rectangular cross-section high beta Tokamak Torus 2. In antiparallel operation, the turbulent E-fields maximize in the region of maximum induced poloidal skin current. The resulting high beta Tokamak plasma, has an intially peaked radial ion temperature profile (approximately 180 eV at that plasma center for 25 GW

antiparallel heating power). Within approximately 10 micron sec, the He 2 determined ion temperature becomes nearly spatially flat, and then decreases slowly in time. However, the frequency of the turbulence increase at lower (approximately 12 GW) anti-parallel heating power. In parallel bias field operation, the induced skin current is lower by roughly a factor of 5 and measureable turbulence does not develop. The He 2-determined ion temperature at 25 GW parallel heating power is comparable to that at 12 GW anti-parallel operation. The measured line profiles also indicate a macroscopic poloidal circulation of plasma ions, which is charged and mass independent. Dissert. Abstr.

N80-30187 Michigan Univ., Ann Arbor.
RADIATION TRANSPORT IN DENSE PLASMAS Ph.D. Thesis
Steven Alan Freije 1980 167 p
Avail: Univ. Microfilms Order No. 8017264

A radiation transport model for line radiation is developed for inclusion in a magnetohydrodynamic computer code. The transport model combines escape and transmission probability theory for optically thin (tau > 1) or strongly absorbing (sigma sub A > sigma sub 5) regions with Eddington theory in optically thick, scattering dominated regions. The magnetohydrodynamic code models one dimensional cylindrically symmetric Z-pinch or exploding wire plasma, solving the MHD equations in the Lagrangian frame. A laser heated aluminum exploding wire plasma is considered. The non-equilibrium exploding wire plasma is considered. The nonequilibrium atomic rate equations are solved to obtain the effective charge of the plasma and the transparent line emission which is used as the source function in the radiation transport model. Simulations with and without radiation transport are compared. The addition of the radiation transport calculations causes a decrease in emission. The emission decreases slightly for an optically thin plasma to as much as 2 to 5 times for an optically thick plasma. The decrease is due to self absorption during transport. Other effects of self absorption on plasma dynamics are discussed. Dissert. Abstr.

N80-30188 Tennessee Univ., Knoxville.
TIME-RESOLVED X-RAY ENERGY SPECTROMETRY AS A PLASMA DIAGNOSTIC METHOD FOR THE OAK RIDGE TOKAMAKS Ph.D Thesis
George Richard Dyer 1980 222 p
Avail: Univ. Microfilms Order No. 8018477

The X-ray emission spectrum from a Tokamak plasma is presented, and the complicating effects of plasma-detector geometry, plasma temperature and density profiles, and impurity radiation are analyzed. The necessary data collection system is described, and the consequences of finite energy resolution, pulse pileup, and other deleterious effects are investigated. Results of these considerations are combined in a procedure to calculate electron temperature (T) and Z effective ion charge (Z) from X-ray energy data and plasma density information, and to estimate the accuracy and reliability of the derived values. The computational procedure is applied to five different classes of Tokamak discharges and the results are compared with T and Z values independently derived through a Thomson-scattering diagnostic. These comparisons show that, in general, agreement between the X-ray diagnostic and accepted techniques is good, and demonstrate the advantages of a time-resolved measurement capable of spanning an entire discharge. Dissert. Abstr.

N80-30189 Maryland Univ., College Park.
PLASMA WAVE STUDIES WITH A WIDE BANDWIDTH SAMPLING CORRELATOR Ph.D. Thesis
Bernard J. Leikind 1979 118 p
Avail: Univ. Microfilms Order No. 8016725

An auto- or crosscorrelator based on a sampling principle is described. By periodically taking extremely short samples of the high frequency wideband input signal its spectrum is compressed and transferred to a frequency band where it can be more easily manipulated. The correlator operates by taking samples in pairs with a controlled delay time between the samples in a pair. Each pair is multiplied and many such products averaged to obtain the value of the correlation function for that particular delay time. If the width of the sample is very short, the bandwidth of the correlator is extremely large. Two studies have been made to evaluate the utility of this correlator for plasma wave studies. In the first study, the correlator was operated as an RF interferometer and the dispersion properties of wave on a magnetized plasma column were investigated. On the basis of the measurements the waves were identified as Trivelpiece-Gould modes. In the second study, the correlator was applied to study the plasma wave turbulence produced by the interaction of an electron beam and a plasma. From the measured cross correlation functions a number of properties of the turbulent waves were deduced. Dissert. Abstr.

N80-30190 Michigan Univ., Ann Arbor.
EXPERIMENTAL STUDY OF PARAMETRIC INSTABILITIES DRIVEN BY FINITE EXTENT LOWER HYBRID WAVES IN A PLASMA Ph.D Thesis
James Everett Stevens 1980 208 p
Avail: Univ. Microfilms Order No. 8017373

The parametric decay of a lower hybrid wave into a lower hybrid sideband and a nonresonant low frequency quasimode was observed in a linear magnetized plasma device. The dispersion properties of this process were measured in a realistic geometry for lower hybrid wave heating. Investigation of the wavenumber versus frequency of the sideband decay waves showed that the parallel wavenumber component of the sideband was different depending on whether the sideband group velocity was in the same or opposite direction to the pump wave. The threshold electric field was measured by a calibrated RF double probe and found to agree with theory. A continuous transition from ion-acoustic mode to quasimode decay spectra was observed to varying the plasma density or pump wave frequency. The results, displayed on contour plots, show the wide range of unstable wavenumbers and frequencies for the nonresonant (quasimode) decay process. The number of e-foldings of the decay waves were calculated, based on a model of convective saturation. Dissert. Abstr.

N80-30191 Florida Univ., Gainesville.
ATOMIC EMISSION AND ATOMIC FLUORESCENCE SPECTROMETRY IN INDUCTIVELY COUPLED PLASMA Ph.D. Thesis
Seifollah Nikdel 1979 242 p
Avail: Univ. Microfilms Order No. 8016562

Molecular emission spectra of native species (OH, NO, and NH) in the argon inductively coupled plasma (ICP) were studied as a function of height in the plasma, input power, and adjacent environment to the plasma. Similar studies were carried out with an ICP into which was introduced moderately concentrated solutions of elements forming stable monoxides, such as SC, Y, Gd, and Lu. The characteristics of the emission line profiles of Ca, Zn, and Mg show that self absorption, while present, is not severe and that self reversal is absent in the observation zones commonly used for analytical measurements. The use of the ICP as excitation source in flame atomic fluorescence spectrometry permitted low limits of detection to be achieved with a simple experimental set up. The reduction of spectral interference observed in ICP emission is demonstrated for the determination of zinc in unalloyed copper. The atomic and ionic fluorescences of iron, tin, barium, and indium excited by flashlamp and nitrogen laser pumed pulsed dye lasers in the ICP were studied. Noise sources were investigated and detectability is compared to the techniques of ICP emission and laser excited atomic fluorescence spectrometry. Dissert. Abstr.

N80-30192 Stanford Univ., Calif.
MEASUREMENTS OF CONDUCTIVITY NONUNIFORMITIES AND FLUCTUATIONS IN COMBUSTION MHD PLASMAS Ph.D. Thesis
Ralph Martin Kowalik 1980 203 p
Avail: Univ. Microfilms Order No. 8016842

Diagnostics for the characterization of electrical conductivity nonuniformities in combustion magnetohydrodynamic (MHD) plasmas were developed. An initial characterization of nonuniformities in the Stanford M-2 linear generator was obtained and recommendations were made concerning the use of the diagnostics in practical MHD generator configurations. A laser induced fluorescene (LIF) diagnostic for nonintrusive measurements of local conductivity fluctuations was developed. This diagnostic and other line of sight averaged optical nonuniformity diagnostics were successfully demonstrated in several experiments

in the Standford M-2 combustion systems. Results were used to characterize the nonuniformities in the M-2 system and to compare and evaluate the diagnostics. Conductivity nonuniformities were found to be predominantly streamers which had relatively long length scales of the order of 1 m in the axial flow direction. Shortest transverse length scales of the order of 0.1 m were found perpendicular to the flow direction. A combination of UF and plasma luminosity diagnostics is recommended for future characterizations of conductivity uniformities in combustion MHD plasmas. Dissert. Abstr.

N80-30193# Naval Weapons Center, China Lake, Calif. Research Dept.
SPECTRA OF PRESSED DISKS OF ALKALI HALIDE WHISKER CRYSTALS INCORPORATING FOREIGN IONS
Marian E. Hills and Allen L. Olsen Apr. 1980 15 p refs
(AD-A085963; NWC-TP-6185) Avail: NTIS HC A02/MF A01 CSCL 07/4

Alkali halide whisker crystals of KCl, KBr, KI, and NaCl were grown readily by allowing aqueous solutions of the salts to pass through porous glass. Whisker crystals of alkali halides doped with MnO4(-), ClO4(-) and ClO3(-) were also grown; not all dopants were used with all host lattices. The whisker crystals may be pressed into disks suitable for obtaining optical spectra. The absorption bands in the spectra of disks pressed from doped whisker crystals were sharper than the spectra of disks pressed from a mechanical mixture of the alkali halide and the dopant. The versatility of the porous glass technique for the growth of whisker crystals is clearly demonstrated. GRA

N80-30194# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
ELECTRON CONDUCTIVITY IN COMBUSTION PLASMAS Final Report, Oct. 1977 - Oct. 1979
L. C. Pitchford and E. C. Beaty Wright-Patterson AFB, Ohio AFWAL Mar. 1980 41 p refs
(MIPR-FY1455-79-00609; AF Proj. 2308)
(AD-A086018; AFWAL-TR-80-2019) Avail: NTIS HC A03/MF A01 CSCL 20/9

The major uncertainty in the calculation of the conductivity in certain plasmas representative of those produced as combustion products in MHD generators is due to the uncertainty in the low energy momentum transfer cross sections for electron scattering in water vapor. The most reliable values of such low energy cross sections are those deduced from electron swarm experiments. The determination of cross sections from swarm experiments involves solving the Boltzmann equation for the electron energy distribution function using some assumed trial set of cross sections. Certain integrals of the distribution function yield the quantities measured in swarm experiments, such as drift velocities and diffusion coefficients. By comparing the calculated values of these measurable quantities with those found experimentally, it is possible to reach useful conclusions about the trial set of cross sections. An iterative procedure can then allow deduction of a set of cross sections which is consistent with swarm observations. The low energy cross sections are thus determined and are some of the most reliable available. GRA

N80-30195# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
BASIC MIRROR STUDIES, TASK 1. BASIC TOKAMAK STUDIES, TASK 2 Annual Progress Report
L. D. Smullin, G. Bekefi, and M. Porkolab 1979 14 p
(Contract DE-AC02-78ET-53076)
(DOE/ET-53076/1) Avail: NTIS HC A02/MF A01

Research progress is reported for each of the following areas: (1) building equipment, (2) RF heating, (3) interspectroscopy, (4) gas puff, (5) mm collective scattering, (6) UV spectroscopy, (7) soft x radiation, (8) charge exchange, and (9) Thomason scattering. DOE

N80-30196# California Univ., Livermore. Lawrence Livermore Lab. National MFE Computer Center.
DYNAMICAL DETERMINATION OF OHMIC STATES OF A CYLINDRICAL PINCH
D. D. Schnack Apr. 1980 6 p refs Presented at the REP Workshop, Albuquerque, N. Mex., 28 Apr. - 2 May 1980
(Contract W-7405-eng-48)
(UCRL-84302) Avail: NTIS HC A02/MF A01

The dual problems of generation and sustainment of the reversed axial field are studied. It is shown that, if a cylindrical plasma is initially in an axisymmetric state with a sufficient degree of paramagnetism, field reversal can be attained by mode activity of a single helicity. The initial paramagnetism may be due to the method of pinch formation, as in fast experiments, or to a gradual altering of the pitch profile resulting from a succession of instabilities. Furthermore, if the total current is kept constant and energy loss and resistivity profiles are included in an ad hoc manner, one finds that the final steady state of the helical instability can be maintained for long times against resistive diffusion without the need for further unstable activity. These states, which possess zero order flow and possibly reversed axial field, represent steady equilibria which simultaneously satisfy force balance and Ohm's law, and are termed Ohmic states. DOE

N80-30197# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
[RESEARCH ACTIVITIES OF THE INSTITUTE FOR PLASMA RESEARCH] Annual Report, 1978 [FORSCHUNGSBERICHT 1978]
1979 49 p refs In GERMAN
Avail: NTIS HC A03/MF A01

Activities in the following areas are described: waves and plasma heating, plasma simulation, high tension belt pinch, laser experiments, and plasma focusing. Author (ESA)

N80-30198# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
THE DISPERSION RELATION OF ELECTROTHERMAL WAVES IN A NONEQUILIBRIUM MAGNETOHYDRODYNAMIC PLASMA
P. Massee Dec. 1978 27 p refs
(TH-78-E-92; ISBN-90-6144-092-0) Avail: NTIS HC A03/MF A01

The experimental verification of the dispersion relation for electrothermal waves is described. The theoretical derivation of this relation as presented differs from the usual approach as the experiment requires an analysis in terms of real frequency and complex wave number. In the experiment, values for electron temperature of up to 2400 K and for electron density of up to 700 exa/cu cm were realized. The properties of the heavy particle gas were not characteristic for the situation in a closed cycle magnetohydrodynamic generator since electrothermal waves are essentially a property of the electron gas only. Hence, the waves were excited artificially in the stable regime so that they were damped, which set high requirements on the measuring technique. The ratio of the amplitudes at two successive double probes was measured as well as the phase shift between the two signals. Experimental results which are discussed and compared with theoretical predictions, show reasonably good agreement for the ratio of amplitides. However, measurements of the phase shift show little agreement with theoretical predictions, a fact for which no explanation can be given. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N80-30199 South Carolina Univ., Columbia.
SURFACE TOPOGRAPHY AND RUTHERFORD BACKSCATTERING Ph.D. Thesis
Ulrich Bill 1979 104 p
Avail: Univ. Microfilms Order No. 8011220

The influence of surface topography on the energy distribution of particles scattered from a sample is studied in a general review and investigated for specific cases. Although there is no one-to-one relationship, the general features of the surface topography are reflected in the specific shape of the spectrum: (1) periodic surface profiles lead to yield oscillations in the spectrum. The oscillation length is directly related to the wavelength of the surface structure and the shape is related to

the type of surface undulations irradiated; (2) in case of a random surface, statistical properties such as the standard deviation from the mean level, and the correlation between surface affect the spectral shape in a specific way. These results were achieved using both analytical and computer calculations. For periodic surfaces, the yield oscillations extend over the whole spectrum and a conservation rule applies to each oscillation. For the random surfaces, the energy spectrum is most affected near maximum energy and the yield is balanced considering the whole spectrum. Dissert. Abstr.

N80-30200 Illinois Univ., Urbana-Champaign.
THERMAL VACANCIES AND PHASE SEPARATION IN BCC MIXTURES OF HELIUM-3 AND HELIUM-4 Ph.D. Thesis
Benedick Andrew Fraass 1980 287 p
Avail: Univ. Microfilms Order No. 8017938

Thermal vacancy concentrations in crystals of (3)He-(4) He mixtures are determined from accurate measurements of the temperature dependence of the X-ray lattice parameter. An X-ray diffractometer-position sensitive detector system is used to make measurements of the absolute lattice parameter of the helium crystals with an accuracy of 300 ppm, and measurements of changes in lattice parameter to better than 60 ppm. The phase separation of the concentrated (3)He-(4) He mixtures were studied in detail with the X-ray measurements. Vacancy concentrations in crystals with 99%, 51%, 28%, 12%, 0% (3)He were determined. The vacancy data in the nearly pure (3)He crystals confirm previous X-ray results from pure (3)He are reported, along with study of vacancies in bcc (4)He. The vacancy concentrations in the 51% and 28% (3)He mixed crystals are found to be as large as 5%. Phase separation was studied in mixed crystals with concentrations of 51%, 28%, and 12% (3)He and melting pressures between 3.0 and 6.1 MPa. The pressure dependence of T sub c, the phase separation temperature for a 50% mixture, is found to be linear: dT sub c = -34 mdeg/MPa. Dissert. Abstr.

N80-30201 Florida State Univ., Tallahassee.
HIGH-TEMPERATURE SERIES EXPANSION TECHNIQUE FOR SYSTEMS WITH COMPLICATED ENERGY LEVELS Ph.D. Thesis
James Wray Johnson 1980 110 p
Avail: Univ. Microfilms Order No. 8016667

An approach to the high-temperature series expansion which is applicable to systems with complicated energy level schemes such as magnetic systems with crystal-field anisotropy of arbitrary strength is formulated. This approach is compared with the original Green's function formulation and the advantage of the present technique is discussed. The approach is applied to the spin-one hard axis Heisenberg ferromagnet and the first four terms in the high temperature series expansion for the free energy, the magnetic susceptibility, and the specific heat are obtained. The formula obtained for the free energy of the spin-one hard-axis ferromagnet also describes spin-one systems with rhombic anisotropy and reduces to the spin-one ferromagnet with an easy-axis anisotropy and to the spin-one simple Heisenberg systems by setting the appropriate matrix elements equal to zero. The method can be extended to treat systems with spin greater than one with general crystal field symmetry. The calculation of higher order terms is rendered tractable using the approach developed here. Dissert. Abstr.

N80-30202 Illinois Univ., Urbana-Champaign.
THE EFFECT OF HYDROSTATIC PRESSURE ON THE IONIC CONDUCTIVITY OF SOME CRYSTALS WITH THE FLUORITE STRUCTURE Ph.D Thesis
James Michael Oberschmidt 1980 180 p
Avail: Univ. Microfilms Order No. 8018192

The ionic conductivity of CaF2, SrF2, BaF2, CdF2, SrCl2, PbF2, PbCl2, PbBr2 and PbI2 was studied at pressures up to 0.6 GPa and temperatures up to near the melting point. The activation volumes for extrinsic vacancy motion were obtained from the effect of pressure on the conductivity of doped and oxygen contaminated samples. The formation volumes of intrinsic defects were calculated from measured activation volumes at high temperatures. The defect formation volumes are found to be uniformly small and consistent with the dominance of Frenkel defects in all cases except PbCl2 and PbBr2, where large formation volumes were observed, indicating Schottky defects. High pressure phase transitions in PbF2, SrCl2 and PbI2 were observed by the change in sample resistance across the transition. The temperature dependence of the ionic conductivity was studied in all of the above materials. Good agreement with published results is obtained except in the cases of PbCl2 and PbBr2. The differences in those two cases are attributed to differences in the fitting procedure used to analyze the data. A large frequency dependence of the measured conductivity at high temperatures is found to exist in all crystals with the fluorite structure. Dissert. Abstr.

N80-30203 Stanford Univ., Calif.
PROPERTIES OF SUPERCONDUCTING WEAK LINKS Ph.D. Thesis
Peter Fowler Michelson 1980 187 p
Avail: Univ. Microfilms Order No. 8016848

Predictions of the resistively shunted junction model for high frequency applications of Josephson junctions are reviewed along with a discussion of phenomena predicted by the microscopic tunneling theory and relaxation models based on time-dependent Ginzburg-Landau theory. Particular attention is focused on the phase-dependent conductivity: the so called cos phi conductance. The discrepancy between theory and experiment in this regard is discussed and suggestions are made about how this discrepancy may be resolved. Microwave reflection measurements on a point-contact in a microwave resonator are described. The data are consistent with the relatively shunted junction model including a phase-dependent conductance with a negative sign. The d.c. 1 to 5 characteristics have also been measured at finite voltage and certain features of these characteristics are discussed. Dissert. Abstr.

N80-30204 Connecticut Univ., Storrs.
SCATTERING OF PHONONS BY POINT DEFECTS IN SOLIDS AND ITS EFFECTS ON THE THERMAL CONDUCTIVITY Ph.D. Thesis
Charles Andriantomanga Ratsifaritana 1979 112 p
Avail: Univ. Microfilms Order No. 8017045

The relation between thermal conductivity and phonon scattering by defects in nonstoichiometric solids (carbides, tin tellurides) and in solids subject to radiation damage is examined. A number of approaches are used to derive an explicit expression of the low frequency scattering relaxation rate. The perturbation theory is first applied in the continuum limit. The Green's function method is applied to a simple cubic crystal in the nearest neighbor approximation: satisfactory agreement with the two previous approaches is obtained for the low frequency region. No low-lying resonance mode was found, suggesting that the observed indentation in the thermal conductivity curves of some irradiated crystal should be accounted for by some other phenomena. The effect of the distortion is also investigated for both the continuum and the discrete models. The main contribution is found to arise from the inner linkages: distortion effects can therefore be disregarded in the case of the vacancy because these linkages are missing. Finally, the expression of the relaxation rate is utilized to explain and interpret some thermal conductivity data of solids believed to contain vacancies. Dissert. Abstr.

N80-30205 Catholic Univ. of America, Washington, D. C.
THERMAL FLUCTUATION EFFECTS FAR FROM THE CRITICAL TEMPERATURE Ph.D. Thesis
Talat Fawzy Refai 1980 194 p
Avail: Univ. Microfilms Order No. 8018348

Measurements of thermal fluctuations in superconductors at temperatures far from the critical temeprature t sub c, and measurements that use thermal fluctuations to probe the nonequilibrium dynamics of a superconductor are reported. Fluctuations that cause a superconductor to switch to the dissipative state and those that cause it to switch back to the superconductor state are measured. These unique measurements allowed: (1) experimental confirmation of the theory of Langer, Ambegaokar, McCumber, and Halpern (LAMH) where t sub c was not an adjustable parameter; (2) verification of the LAMH model far from t sub c; (3) experimental confirmation of the relation between current and transition probability that was predicted in the LAMH model; (4) confirmation that the Lamda model developed by Peters, Wolf, and Rachford (PWR) to explain the dynamics on the nonequilibrium region can be extended to

explain fluctuation effect; and (5) the most direct measurement to date of the nature of the decay of the dissipative region in a weak link. These measurements show that the region recovery exponentially in time as proposed in the Lamda model.
Dissert. Abstr.

N80-30206 Connecticut Univ., Storrs.
INFLUENCE OF DEFECTS ON THE ULTRASONIC ATTENUATION OF DIELECTRIC CRYSTALS Ph.D. Thesis
Victor Lawrence Taylor 1980 237 p
Avail: Univ. Microfilms Order No. 8017052

Anharmonic interactions among lattice waves limit the phonon mean free path and give rise to both the ultrasonic attenuation and the thermal resistivity of dielectric solids. Lattice defects influence both of these properties by further reducing the phonon mean free path. The ultrasonic attenuation is interpreted in terms of the Landau-Rumer theory at low temperatures and the Akhieser theory at higher temperatures, the transition between the two regimes being at about 40 to 50 K. An apparatus is described for measuring acoustic attenuation over a wide temperature range. The attenuation data were corrected for nonparallelism, and finite sample width using theoretically derived correction functions. The attenuation is consistent with previous measurements at different frequencies. It appeared that cooling to low temperatures caused extensive defects which contributed to the residual attenuation and which could be removed only partly by annealing at room temperature. Such defects were also clearly evident from the thermal conductivity, which was well below the boundary scattering or Casmir limit at low temperatures. Dissert. Abstr.

N80-30207 Stanford Univ., Calif.
EXCITED STATE DYNAMICAL PROCESSES IN MOLECULAR CRYSTALS: OPTICAL COHERENCE EXPERIMENTS Ph.D. Thesis
Donald Edward Cooper 1980 134 p
Avail: Univ. Microfilms Order No. 8016815

A dye laser system was constructed to perform photon echo experiments. It consisted of an acousto-optically modelocked and Q-switch Nd:YAG laser synchronously pumping a cavity dumped dye laser. The result was a high power tunable single pulse at 200 Hz. The photon echo experiments were performed on dilute mixed crystals of pentacence in a naphthalene host at 1.4 K, and homogeneous linewidths of 10 to 40 MHz were measured. A concentration dependent component of the linewidth was observed and a model is presented which attributes this to modulation of the guest-guest intermolecular interactions by acoustic phonons. At lowest concentrations a residual linewidth is observed in addition to that due to lifetime broadening and this is attributed to phonon modulation of the guest-host van der Waals interaction. All echo decays were exponential, implying that the homogeneous line is Lorentzian. A theoretical discussion of spin orbit coupling in exciton systems is presented.
Dissert. Abstr.

N80-30208# IBM Watson Research Center, Yorktown Heights, N.Y.
SPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF METAL-SEMICONDUCTOR AND VACUUM-SEMICONDUCTOR INTERFACES Final Report, 1 Oct. 1976 - 31 Oct. 1979
Dean E. Eastman 24 Mar. 1980 37 p refs
(Contract F44620-76-C-0041; AF Proj. 2306)
(AD-A085673; AFOSR-80-0455TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

The electronic structure and properties of semiconductor interfaces including both vacuum-semiconductor and metal-semiconductor interfaces as well as relevant metal and semiconductor materials have been investigated under this contract. The emphasis is on elucidating the electronic properties of these materials and their interfaces, e.g., metal-semiconductor Schottky barriers, which are of far reaching importance in such semiconductor devices as MOSFETS, CCD devices, photovoltaic devices, etc. Extensive studies of the electronic structure of semiconductor surfaces and interfaces and related metal surfaces as a function of surface preparation, doping, thickness of adsorbed overlayer, etc. has been performed. GRA

N80-30209# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Electronic Technology Div.
CHARACTERIZATION OF 3-5 COMPOUND SEMICONDUCTOR DEVICE MATERIALS Final Report, 1 Jul. 1975 - 1 Oct. 1979
D. C. Reynolds Feb. 1980 36 p refs
(AF Proj. 2306)
(AD-A085565; AFWAL-TR-80-1016) Avail: NTIS HC A03/MF A01 CSCL 20/12

The objective of this task has been the electrical, optical, and magneto-optical characterization of the intrinsic and extrinsic properties of compound semiconductors, primarily from the III-V group of materials. Photoluminescent techniques were used to identify both the intrinsic and extrinsic properties of the materials. Intrinsic properties such as energy band gaps, effective mass parameters, refractive indices, dielectric functions, exciton binding energies and lattice vibration frequencies were determined. Extrinsic properties including activation energies of foreign impurities, binding energy of excitons to foreign impurities and the energies of complexes were established. Transport measurements were used to measure carrier mobilities and electrical conductivity as well as carrier concentrations. These measurements as a function of temperature make it possible to determine the number of donors (N sub D) and the number of acceptors (N sub A) and therefore the compensation ratio in the material. Local vibrational mode spectroscopy was used as a characterization tool to identify specific impurities such as C and Si in GaAs. From the vibrational energy the site location of the impurity can be determined. These characterization techniques have been very successful in evaluating the quality of materials and have been very helpful to the crystal growing program which has been successful in growing very high quality materials. GRA

N80-30210# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
ELECTRICAL PROPERTIES AND PHOTOLUMINESCENCE OF GERMANIUM-IMPLANTED GALLIUM ARSENIDE M.S. Thesis
Siv-Sing Chan Dec. 1979 55 p refs
(Contracts N00014-76-C-0806; N00014-79-C-0424)
(AD-A085891; R-872; UILU-ENG-80-2204) Avail: NTIS HC A04/MF A01 CSCL 20/12

The data presented show that Ge-implanted GaAs has a complex amphoteric behavior which is controlled by the implantation dose, implantation temperature and anneal temperature. Annealing was performed with R.F. plasma deposited Si3N4 as the encapsulant. Implantations at -100 C resulted in p-layers while those performed at 100 C and above resulted in n-layers regardless of the dose and anneal temperature. Room temperature implants resulted in p- or n-layers depending on the combination of dose and anneal temperature. Electrical activation and carrier mobilities in the implanted layers were low. Low temperature (6 K) photoluminescence indicated that a significant amount of residual damage remained after annealing. Carrier concentration profiles in implanted layers and junction characteristics of Ge-implanted GaAs planar diodes are also presented. GRA

N80-30211# Colorado State Univ., Fort Collins. Dept. of Physics.
MAGNETORESISTANCE MOBILITY PROFILING OF MESFET CHANNELS
J. R. Sites and H. H. Wieder Apr. 1980 19 p refs
(Contract N00014-76-C-0976; RR021203)
(AD-A086078; SF-27) Avail: NTIS HC A02/MF A01 CSCL 20/12

Magnetoresistance provides a straightforward, nondestructive technique for determining the carrier mobility in the conducting channel of field effect transistors (FETs) over their full range of operation. The analysis is well suited to the typical FET geometry. The technique is illustrated here by a comparative study of GaAs depletion mode FET devices. GRA

N80-30212# RCA Labs., Princeton, N. J.
DEVELOPMENT OF 1.0- TO 1.4-MICROMETER HETEROJUNCTION LEDs Final Technical Report, 17 Apr. 1978 - 16 Mar. 1979
G. H. Olsen, Michael Ettenberg, C. J. Nuese, and Dan Botez Griffiss AFB, N. Y. RADC Apr. 1980 64 p refs

(Contract F19628-78-C-0105; AF Proj. 4600)
(AD-A086082; PRRL-79-CR-18; RADC-TR-80-11) Avail: NTIS HC A04/MF A01 CSCL 09/1

Both VPE and LPE InGaAsP/InP edge- and surface-emitting LEDs have been fabricated and tested under the present contract. Table 1 contains a summary of the results. Although the surface emitter provides greater total power, its halfwidth is considerably larger than that of the edge emitter. This increases pulse dispersion and reduces the amount of power that can be coupled into an optical fiber. The experimental conditions for the vapor-phase growth of InGaAsP and InP alloy are described. Detailed growth procedures are specified and plots of alloy composition, bandgap, lattice parameter and doping levels vs growth parameters are included. Modulation rates close to 100 MHz have been measured for 1.27 micron edge-emitting LEDs. Fall times on the order of 10 ns for (90 to 10% response) also have been obtained. Over fifty edge emitting VPE 1.27 micron heterojunction LEDs have been fabricated from numerous wafers. External power efficiencies equal to or greater than 0.3% were routinely measured, with maximum efficiencies on the order of 0.7% (from one edge). Wafer-to-wafer reproducibility of power efficiencies has now been demonstrated with both the LPE and VPE growth techniques. GRA

N80-30213# Maine Univ., Orono. Dept. of Physics and Astronomy.
LATTICE GAS MODELS FOR CHEMISORPTION ON STEPPED SURFACES
P. Kleban Jun. 1980 15 p refs
(Contract N00014-79-C-0441; NR Proj. 392-032)
(AD-A086075; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/2

We consider the theory of chemisorption on stepped surfaces for systems for which a lattice gas in thermodynamic equilibrium is an appropriate model. Using statistical mechanics we demonstrate that by comparing LEED (Low Energy Electron Diffraction) results for flat and stepped substrates one can determine the change in adsorption energy at terrace edges. Thus one can answer the important question of whether adatoms bind more or less strongly at this kind of defect site. We also examine some new and interesting features of LEED spot shapes and integrated intensity behavior for adsorption on stepped substrates when the overlayer is partially disordered. In a companion paper, we consider O on a certain stepped W(110) surface. We demonstrate there, via Monte Carlo calculations, that the binding energy is less strong on either terrace edge for this particular adsorbate, surface and defect. GRA

N80-30214# Varian Associates, Palo Alto, Calif.
INVESTIGATION OF InP TECHNOLOGY Final Technical Report, 1 Aug. 1978 - 1 Aug 1979
George A. Antypas Griffiss AFB, N.Y. RADC Jan. 1980 33 p refs
(Contract F19628-77-C-0141; AF Proj. 2306)
(AD-A086012; RADC-TR-79-330) Avail: NTIS HC A03/MF A01 CSCL 20/12

The reaction rate for the synthesis of high-purity InP has been increased to 2.5 cm/day by increasing the reservoir temperatures to 460 C and 1040 C for P and In respectively. Characterization of the material by van der Pauw and photoluminescence measurements indicates the same background carrier concentration as that prepared at lower temperatures and therefore lower rates. Zero dislocation density n(+) S-doped and p(+) Zn-doped InP single crystals can be prepared routinely by LEC. GRA

N80-30215# General Electric Co., Schenectady, N. Y.
ALUMINUM NITRIDE CRYSTAL GROWTH Final Report, 1 Nov. 1978 - 31 Oct. 1979
G. A. Slack Dec. 1979 32 p refs
(Contract F49620-78-C-0021; AF Proj. 2306)
(AD-A085932; SRD-80-056; AFOSR-80-0424TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report summarizes the progress made during the year in growing single crystals of AlN from precursors prepared by the reaction of high purity aluminum droplets with ammonia. Crystal growth was achieved by vapor phase transport and sublimation. A new scheme for preparation of AlN from metal-organics is proposed. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

N80-30216# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE ROLE OF THE SECOND LAW OF THERMODYNAMICS IN MECHANICS OF MATERIALS
P. M. Naghdi Oct. 1979 16 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A085563; UCB/AM-79-3) Avail: NTIS HC A02/MF A01 CSCL 20/13

This paper summarizes the recent work of Green and Naghdi concerning the thermomechanics of dissipative materials, the main features of which are: (a) The introduction of a conservation law for entropy which holds for all materials, (b) the use of the energy equation as an identity for all processes, thereby leading to restrictions on constitutive equations, and (c) the development of an inequality representing a mathematical interpretation of a statement of the second law of thermodynamics. GRA

N80-30217# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.
RECENT ADVANCES IN COOPERATIVE PHENOMENA AND MATTER FIELD INTERACTIONS
D. W. Howgate, C. M. Bowden, C. A. Coulter (Alabama Univ., University), and C. C. Sung (Alabama Univ. in Huntsville) Jan. 1980 34 p refs Presented at the Vavilov Conf. on Coherent and Nonlinear Optics, Novosibirsk, USSR, 20-22 Jun. 1979
(AD-A085946; DRSMI/RR-80-2) Avail: NTIS HC A03/MF A01 CSCL 20/10

Recent breakthroughs in the areas of swept-gain superradiance, laser induced chemistry, and optical bistability led to a broad program which encompasses and is relevant to the major areas of specialization in coherent cooperative effects being undertaken at universities under Government sponsorship. In addition to the obvious applications, a deeper and more profound understanding of advanced directed radiation and phase changes in matter/light interactions was developed through the appropriate utilization of basic first principles and the in-depth analysis and study of coherent cooperative behavior. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-30218# Decisions and Designs, Inc., McLean, Va.
OVAL AND GENTREE: TWO APPROACHES TO PROBLEM STRUCTURING IN DECISION AIDS
Jonathan J. Weiss Apr. 1980 157 p refs
(Contract N00014-79-C-0068; ARPA Order 3668)
(AD-A086059; TR-80-3-97) Avail: NTIS HC A08/MF A01 CSCL 09/2

Decision analysis is a technology which offers the decision maker a logical structure for solving a specific problem. Through the process of decision analysis, the decision maker may select from several options the one that best suits his/her needs. In practical applications, most decision analytic techniques require a specially trained decision analyst and a sizeable amount of time and expense. This report describes two computer-assisted decision aids which are designed to perform preliminary decision analyses in the absence of a professional decision analyst and for a restricted set of decision problems. The first decision aid, QVAL (Quick Evaluation), has been implemented on an IBM 5110 portable computer and is ready for operation on an experimental basis. QVAL is an interactive program designed to probe the user's memory for a complete set of attributes together with the scores and weights for a consistent evaluation of a set of options. The second decision aid, GenTree (Generic Tree Structuring), is still in the planning stage, but promises to be very valuable in storing experience and knowledge gained while working on problems and applying it to guide the analysis of subsequent ones. By utilizing prior knowledge stored in the GenTree database, this decision aid would approximate the performance of a decision analyst on familiar problem types. In contrast, QVAL would more resemble the performance of the decision analyst on a completely new application area. With the continuing progress being made in the fields of artificial intelligence and interactive computer graphics, more sophisticated computer-assisted decision aids of this nature may be designed. GRA

N80-30219# Honeywell Systems and Research Center, Minneapolis, Minn.
DECENTRALIZED CONTROL Final Report, 1 Jul. 1978 - 30 Dec. 1979
E. D. Jensen May 1980 34 p refs
(Contract N00014-78-C-0511)
(AD-A085956; HONEYWELL-80SRC36) Avail: NTIS HC A03/MF A01 CSCL 12/1

A conceptual model of decentralized control for computer systems is presented. The model is founded on the principle that an activity at any particular level of abstraction is decentralized if there is no unique lowerlevel entity which enforces a consistent view of the activity state on the entities involved in that activity. Three factors are presented to determine how decentralized the control of an individual resource is: the number of controllers of a resource, the extent that each controller is involved in every control activity, and the parity of the controllers: authority. Two factors are presented to determine the decentralization of system-wide control: the number of controllers involved in each instance of multilateral management and the number of resources involved in each instance of multilateral management. Physical communication issues are discussed which effect the logical decentralization of control. Communication is considered to consist of the production and manifestation of signals. The observability of signals is the practical difference between the signal production and manifestation. Three factors of signal observability are presented: completeness, coherence, and latency. GRA

N80-30220# Massachusetts Inst. of Tech., Cambridge.
THE INTRODUCTION OF FEEDBACK INTO A HIERARCHICAL PRODUCTION PLANNING SYSTEM
Stephen C. Graves Mar. 1980 31 p refs
(Contract N00014-75-C-0556)
(AD-A085833; TR-177) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper proposes and tests a framework for decomposing a large scale production planning problem, modeled as a mixed-integer linear program. We interpret this decomposition in the context of Hax and Meal's hierarchical framework for production planning. The procedure decomposes the production planning problem into two subproblems which correspond to the aggregate planning subproblem and a disaggregation subproblem in the Hax-Meal framework. The linking mechanism for these two subproblems is an inventory consistency relationship which is priced out by a set of Lagrange multipliers. The best values for the multipliers are found by an iterative procedure which may be interpreted as a feedback mechanism in the Hax-Meal framework. At each iterative, the procedure finds both a lower bound on the optimal value to the production planning problem and a feasible solution from which an upper bound is obtained. Our computational tests show that the best feasible solution found from this procedure is very close to optimal. For thirty-six test problems the percentage deviation from optimality never exceeds 4.4%, and the average percentage deviation is 2.2%. Twenty-seven of the test problems are mixed-integer linear programs with 240 zero-one variables, while nine test problems have 480 zero-one variables. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-30221 Michigan Univ., Ann Arbor.
A COMBINED COMMUNICATION NETWORK DESIGN AND FILE ALLOCATION FOR DISTRIBUTED DATABASES Ph.D. Thesis
Nicholas George Khabbaz 1980 160 p
Avail: Univ. Microfilms Order No. 8017291

The combined problem of communication network design and file allocation for distributed databases is addressed. The network topologies are restricted to be maximally connected and of minimal diameter. A model is proposed to find an optimal communication network and allocation of files that minimize the total cost of file storage and of the communication channels. The model takes into consideration network reliability, file availability, and communication delay constraints. It was shown that the network reliability constraint puts a lower bound, kappa sub m, on the network connectivity kappa, the file availability constraints put lower bounds on the number of copies of each file, and the delay constraints put lower bonds on the channel capacities. A heuristic algorihtm to solve the model is then described and some results are presented. The results show that, in some cases, the optimal solution is obtained when kappa = kappa sub m. In other cases, however, increasing kappa results in the reduction of the total cost, and the improvement of both the network reliability and the file availability. Dissert. Abstr.

N80-30222# Naval Research Lab., Washington, D. C.
MINIMUM CROSS-ENTROPY PATTERN CLASSIFICATION AND CLUSTER ANALYSIS
John E. Shore and Robert M. Gray 10 Apr. 1980 26 p refs
(AD-A086158; AD-E000434; NRL-MR-4207) Avail: NTIS HC A03/MF A01 CSCL 09/4

This paper considers the problem of classifying an input vector of measurements by a nearest-neighbor rule applied to a fixed set of vectors. The fixed vectors are sometimes called characteristic feature vectors, codewords, cluster centers, models, reproductions, etc. The nearest neighbor rule considered uses a non-Euclidean, information-theoretic distortion measure that is not a metric, but that nevertheless leads to a classification method that is optimal in a well defined sense and is also computationally attractive. Furthermore, the distortion measure results in a simple method of computing cluster centroids. Our approach is based on cross-entropy minimization (also called minimum discrimination information or minimum directed divergence), and can be viewed as a refinement of a general classification method due to Kullback. The refinement exploits special properties of cross-entropy that hold when the probability densities involved happen to be minimum cross-entropy densities. The approach is a generalization of a recently-developed speech coding technique. GRA

N80-30223# Massachusetts Inst. of Tech., Cambridge. Nuclear Science Lab.
FEASIBILITY STUDY OF NETWORKS Final Report, Jul. 1974 - Dec. 1979
Elizabeth J. Campbell and Muriel S. Kannel 15 Dec. 1979 20 p refs
(Contract DE-AC02-76ER-02487)
(DOE/ER-02487/7) Avail: NTIS HC A02/MF A01

Experiments were performed at various ERDA installations

on the ARPANET in using the networks for offloading large calculations and obtaining access to unique hardware and software. Performance statistics were collected and cost comparisons, made. Both the benefits and barriers of networking were analyzed. The value of electronic mail, teleconferencing, and other forms of computer aided communication was also investigated. The study demonstrated that resource sharing via networks can provide small computer installations access to computer facilities not available on site. However, it is not adequate substitute for an on-site computer. There must be enough computing power locally to service the average load. Certain types of computations are effectively done on the network. Use of the network is most feasible for access to powerful processors and large memories or to unique hardware such as vector processor. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-30224# Committee on Science and Technology (U. S. House).
DOE AUTHORIZATION, 1981, VOLUME 2
Washington GPO 1980 720 p Hearings before the Subcomm. on Energy Res. and Production of the Comm. on Sci and Technol., 96th Congr., 2nd Sess., no. 114, 5, 7, 12, 13 Feb. and 4 Mar. 1980
(GPO-61-774-Vol-2) Avail: Subcommittee on Energy Research and Production

Testimony given on the Department of Energy's budget request for fiscal year 1981 is presented. An overview of the Nation's nuclear energy programs is given. Emphasis is placed on energy production from nuclear power to meet electrical energy needs for the remainder of the century. Nuclear plant safety and reliability, nuclear waste disposal and management, light water reactor technology, advanced fission technology, breeder reactor technology, spent fuel storage and reprocessing, and advanced isotope separation techihology are among the topics discussed. J.M.S.

N80-30225# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, VOLUME 5
Washington GPO 1980 1164 p Hearings on H.R. 6413 before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 18, 20, 21, 26 Feb., 7-10, 31 Mar. 1980
(GPO-61-213-Vol-5) Avail: Subcommittee on Space Science and Applications

Testimony given on the cooperative energy programs being conducted by NASA for the Department of Energy is presented in light of the budget request for fiscal year 1981. Solar energy activities including small dispersed solar system applications and bioenergy as well as ocean thermal energy conversion, solar augmented desalination systems, and solar ranking applications are discussed. Coal preparation and conversion technologies are also considered. These technology options include coal gasification and liquefaction processes, coal gasifier congeneration systems, and coal fired energy conversion systems. Concepts that would extend the use of advanced systems based in space are examined, including the satellite power systems, orbiting reflectors, and lunar based power plants. The NASA support to the DOE in the solar programs areas of solar heating and cooling, wind energy, solar cells-photovoltaic conversion systems, and high temperature thermal conversion systems is highlighted. J.M.S.

N80-30228# Committee of Conference (U. S. Congress).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1981
Washington, D.C. GPO 1980 5 p
(Pub-Law-96-316; GPO-59-139) Avail: US Capitol, Senate Document Room

The congressional act authorizing appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management is presented. A breakdown of allocations to specific projects is provided, and expenditure provisions are outlined. M.G.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-30227 Columbia Univ., New York.
ALTERATION AND ADAPTION AS DECISION-MAKING CRITERIA FOR THE TRANSFER OF TECHNOLOGY Ph.D. Thesis
Hyo Joon Hahm 1978 187 p
Avail: Univ. Microfilms Order No. 8016957

The patterns of transfer of technology are discussed. It is suggested that the effective transfer of technology is directly related to the capability of the technology recipient to (1) alter the imported technology to conform to defined local conditions; (2) to adapt itself to that technology; or (3) both. Criteria for the effective transfer of technology (alteration and adaptation) are identified and their importance is demonstrated. Dissert. Abstr.

N80-30229*# Ford Motor Co., Dearborn, Mich.
REGENERATOR MATRIX PHYSICAL PROPERTY DATA
C. A. Fucinari May 1980 51 p refs
(Contracts DEN3-8; EC-77-A-31-1044)
(NASA-CR-159854; DOE/NASA/0008-80/11) Avail: NTIS HC A04/MF A01 CSCL 05A

Among several cellular ceramic structures manufactured by various suppliers for regenerator application in a gas turbine engine, three have the best potential for achieving durability and performance objectives for use in gas turbines, Stirling engines, and waste heat recovery systems: (1) an aluminum-silicate sinusoidal flow passage made from a corrugated wate paper process; (2) an extruded isosceles triangle flow passage; and (3) a second generation matrix incorporating a square flow passage formed by an embossing process. Key physical and thermal property data for these configurations presented include: heat transfer and pressure drop characteristics, compressive strength, tensile strength and elasticity, thermal expansion characteristics, chanical attack, and thermal stability. A.R.H.

N80-30229*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A LABORATORY FACILITY FOR ELECTRIC VEHICLE PROPULSION SYSTEM TESTING
Noel B. Sargent 1980 11 p refs Presented at Intern. Congr. of Transportation, Dearborn, Mich., 15-17 Sep. 1980; sponsored in cooperation with Vehicle Technology Society and IEEE, Society of Automotive Engineers, and Inst. of Electrical Engineers
(NASA-TM-81574; DOE/NASA/1011-32; E-544) Avail: NTIS HC A02/MF A01 CSCL 13F

The road load simulator facility located at the NASA Lewis Research Center enables a propulsion system or any of its components to be evaluated under a realistic vehicle inertia and road loads. The load is applied to the system under test according

to the road load equation: F(net) = K1F1 + K2F2V + K3 sq V + K4(dv/dt) + K5 sin theta. The coefficient of each term in the equation can be varied over a wide range with vehicle inertial representative of vehicles up to 7500 pounds simulated by means of flywheels. The required torque is applied by the flywheels, a hydroviscous absorber and clutch, and a drive motor integrated by a closed loop control system to produce a smooth, continuous load up to 150 horsepower. A.R.H.

N80-30230*# Office of Science and Technology, Washington, D. C.
WHAT CAN BE DONE TO IMPROVE INTERGOVERNMENTAL SCIENCE AND TECHNOLOGY
Paul R. Brockman 2 Jan. 1979 49 p
(NASA-TM-81123; PB80-170491) Avail: NTIS
HC A03/MF A01 CSCL 05L

Science and technology can make a more significant contribution to state and local governments than they are now making. That is a major conclusion to be drawn from the views of more than 130 individuals who are involved as leaders in current efforts to apply science and technology to state and local needs. These views are expressed in response to a questionnaire administered by the staff of the Office of Science and Technology Policy in the Executive Office of the President in the Fall of 1978. GRA

N80-30231# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM, PHASE 2. VOLUME 1: CONTROL SYSTEM IMPROVEMENTS Final Report
J. N. Beberstein, J. F. Robinson, W. A. Scott, and D. F. Sellers Oct. 1979 63 p refs
(PB80-175193; UMTA-TX-06-0020-79-2-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 13F

The control system improvements incorporated in the P40 vehicle and the AIRTRANS supervisory data system software additions for dual block occupancy alarm features and P40 passenger vehicle identity are described. Under the control system improvements, the objectives were to continue development of the longitudinal velocity control systems as embodied in a new third generation Vehicle Control and Electronics Unit; implement improved functional design features in the areas of data communications, directional reversability, dual side doors, automatic test and checkout capability, built-in manual control, slip/slide detection, supervisory data system software and improved entrainment capability. Significant progress in the AIRTRANS control system's area is demonstrated in simulation, laboratory tests, and guideway evaluation. GRA

N80-30232# Vought Corp., Dallas, Tex.
AIRTRANS URBAN TECHNOLOGY PROGRAM, PHASE 2. VOLUME 2: IMPROVED PASSENGER COMMUNICATION Final Report
Richard S. Jacobsen and Conrad M. Schultz Oct. 1979 54 p refs
(PB80-175201; UMTA-TX-06-0020-79-3-Vol-2) Avail: NTIS
HC A04/MF A01 CSCL 13P

The primary objectives were to design, build, and demonstrate: (1) an onboard television surveillance system; (2) a programmable audio-announcement unit; (3) a dynamic graphic system; and (4) a time-to-arrival display unit for passenger stations. All of these systems were built and successfully demonstrated as part of the operation of a prototype urban Automated Guideway Transit vehicle in the Dallas/Fort Worth AIRTRANS system. GRA

N80-30233# Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
COMPUTER-AIDED SYNTHESIS OF WASTEWATER TREATMENT AND SLUDGE DISPOSAL SYSTEMS Inhouse Report, Feb. - Oct. 1978
Lewis A. Rossman Dec. 1979 162 p refs
(PB80-174220; EPA-600/2-79-158) Avail: NTIS
HC A08/MF A01 CSCL 13B

A computerized system synthesis model called EXEC/OP is described that can aid the designer in the preliminary stages of the system design process. The various features of the model are discussed and a number of sample design problems that illustrate its versatility are presented. R.C.T.

N80-30234# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
ASSESSMENT OF INTEGRATED URBAN ENERGY OPTIONS
Gerald D. Pine Feb. 1979 236 p refs
(PB80-173644; MIT-EL-79-021) Avail: NTIS
HC A11/MF A01 CSCL 13A

An initial comparison is carried out for the following residential space and water heating options: electric resistance heating, electrically driven heat pumps, distribution of condenser temperature water combined with heat pumps to extract heat at the point of use, district heating via hot water from a combined heat-electric utility energy source, and individual gas furnaces. This comparison indicates that district is potentially competitive with conventional technologies for new urban areas. Base case urban models, economic assumptions, and distribution networks are defined and a computer program is developed to select optimum pipe sizes for the networks and to calculate life cycle costs. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-30235 Harvard Univ., Cambridge, Mass.
FAR-INFRARED OBSERVATIONS OF THE GALACTIC PLANE REGION SOUTHWEST OF M17 Ph.D. Thesis
Mark Terence Stier 1980 201 p
Avail: Univ. Microfilms Order No. 8018160

A 7.5 square degree region of the galactic plane near l = 13.5 deg was surveyed with the Center for Astrophysics/University of Arizona 1.02 m balloon-borne telescope and a 1 aremin resolution 40 to 250 photometer. Forty-three far-infrared sources were detected. Comparison of the far-infrared and radio continuum flux densities of seventeen HII regions in the surveyed area indicates that dust does not significantly alter their ionization structure. Several of the far-infrared sources are not also strong radio continuum sources and may be late-O or early-B stars embedded in the M17SW giant molecular cloud. The W33 complex was resolved into several far-infrared sources for the first time. The far-infrared peak near the maser source W33A, a source probably at an early stage of stellar evolution, is unresolved with the l are min beam and has a bolometric luminosity of 1.6 x 100,000. Dissert. Abstr.

N80-30236 Harvard Univ., Cambridge, Mass.
ARRAY PHOTOMETRY OF ELLIPTICAL GALAXIES Ph.D. Thesis
Robert Williams Leach 1979 164 p
Avail: Univ. Microfilms Order No. 8018159

Photometry is presented for elliptical galaxies based on images obtained with a new photometric array camera consisting of 100 x 100 silicon diodes. Laboratory measurements and observations of standard astronomical objects at the telescope illustrate the performance of the camera. Observations of the rotation of position angle of the isophotes in a sample of nearby elliptical galaxies are interpreted as being caused by projection effects acting on triaxial ellipsoids with substantial ellipticity gradients. The ellipticity and position angle properties of the first-ranked galaxies in a sample of nearby Abell clusters are derived and shown to be consistent with those of the nearby ellipticals. Synthesized aperture magnitudes are derived for this

sample of Abell cluster galaxies. This establishes the ability of the instrument to make absolute photometric measurements and reproduces the observed dispersion in absolute magnitude. Finally, no significant correlations are found among seven observables in a sample of nearby ellipticals except for those among absolute magnitude, effective radius, and velocity dispersion; these are caused by the constraint of a constant mass to light ratio for the galaxies. Dissert. Abstr.

N80-30237 Academy of Sciences (USSR), Moscow. Inst. of Space Research.

DESIGN PROBLEMS OF LARGE, SPACE, MIRROR RADIO TELESCOPES

A. S. Gvamichava, V. I. Buyakas, N. S. Kardashev, N. P. Melnikov, A. G. Sokolov, G. S. Tsarevsky, and V. I. Usyukin 1979 25 p refs

(D-282) Copyright. Avail: NTIS HC A02

The development of radio astronomical techniques using millimeter wavelengths for astrophysical and other applied investigations is discussed. Specifically, orbital mirror antennas with a parabolic or spherical shape are considered. The choice of an optimal structural frame, either partially or wholly self deployed so as to minimize spacecrew EVA, is studied. Design effects on reflection surface precision are taken into account. The control simulation of a spherical mirror model composed of single-type modules interconnected by links, some of which are adjustable, is presented. Author (ESA)

N80-30238 Academy of Sciences (USSR), Moscow. Inst. of Space Research.

ON SUBMILLIMETER PHOTOMETRY OF MOLECULAR DUST CLOUDS AND OTHER GALAXIES

G. B. Sholomitsky 1979 20 p refs

(P-278) Copyright. Avail: NTIS HC A02

Estimates of submillister radiation fluxes at 350 micron wave lengths from dark, molecular dust clouds and from other galaxies were obtained based on radio spectroscopic data and on empirical correlation between CO and submillimeter continuum otptical depths. The expected level of emission is shown to be measurable with existing ground based telescopes. The importance of such observations is discussed. Photometric equipment with cryogenically cooled bolometers were developed for observations in the 350, 460, and 650 micron atmospheric windows, as well as in the infrared, by means of the 6m telescope and of a 70 cm telescope. Furthermore, it is shown that the photometers can be supplemented by polarimetric units for future submillimeter linear polarization measurements. Much attention is given to thorough spectral filtering, without which high quality photometric observations in the submillimeter range are impossible.

Author (ESA)

N80-30239 Academy of Sciences (USSR), Moscow. Inst. of Space Research.

CURVATURE RADIATION OF RELATIVISTIC PARTICLES IN THE MAGNETOSPHERE OF PULSARS: THEORY

V. V. Ochelkov and V. V. Usov 1979 39 p refs

(Pr-508) Copyright. Avail: NTIS HC A03

The curvature radiation of charged relativistic particles in a dipole magnetic field is considered, taking into account the possibility of radiation reabsorption by the emitting particles themselves. The calculations are carried out for emanating particles with monoenergetic power spectra. The frequency and angular dependencies of the curvature radiation flow between the magnetic axis and the line of sight is determined. The calculated results can be used for interpreting data from pulsar observations.

Author (ESA)

N80-30240*# Illinois Univ., Urbana. Astronomy Dept.

ILLINOIS OCCULTATION SUMMARY, 1. 1977 - 1978

Richard Radick and David Lien 19 Feb. 1980 31 p refs

(Grant NGR-14-005-176; Contract DE-AC02-76ER-03077)

(NASA-CR-163407) Avail: NTIS HC A03/MF A01 CSCL 03A

Instrumentation and data acquisition techniques used to record lunar occultations at the University of Illinois Prairie Observatory are described. Tables and graphs summarize data from 64 events which include 30 observations of stars brighter than 7th magnitude, 40 reappearances, 4 angular diameter measurements, 8 observations of binary stars, and 6 observations which may indicate multiplicity. A.R.H.

N80-30241*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.

THE RATE OF MASS LOSS AND VARIATIONS IN THE WIND FROM THE BE STAR DELTA CENTAURI

Theodore P. Snow, Jr., William R. Oegerle (Princeton Univ. Observatory, N.J.), and Ronald S. Polidan (Princeton Univ. Observatory, N.J.) [1980] 19 p refs

(Contract NAS5-23576; Grant NsG-5355)

(NASA-CR-163427) Avail: NTIS HC A02/MF A01 CSCL 03A

Copernicus ultraviolet scans of the Be star delta Centauri obtained in 1976 and 1979, show a significant variation in the Si III lambda 1206 profile. The strong asymmetry that was present in 1976 had disappeared by 1979. The Si IV lambda 1400 doublet was also asymmetric in 1976, but was not observed in 1979. A quantitative fit of the line shapes to theoretical wind profiles shows that the mass-loss rate in 1976 was 2 x 10 to the minus 8th power/yr, and that the rate of mass loss in Si III was at least one order of magnitude less in 1979. It is not possible to determine whether the variation represented an overall change in the lass-loss rate, or whether it was due to a change in the ionization balance. The profile fitting procedure resulted in the adoption of assumed underlying photospheric Si III and Si IV profiles, and the equivalent widths measured from these profiles are most consistent with T sub eff between 30,000 and 35,000 K, somewhat hotter than implied by the spectral classification normally assigned to this star. The ultraviolet photospheric line widths, coupled wit published theoretical analyses of rotational gravitational darkening, imply an intrinsic equatorial velocity of about 310 km/sec and an angle of inclination of the rotational axis to the line of sight of i is less than or equal to 44 deg. Author

N80-30242*# Cambridge Univ. (England). Inst. of Astronomy.

EXTRAGALACTIC H 2 REGIONS IN THE UV: IMPLICATIONS FOR PRIMEVAL GALAXIES AND QUASARS

David L. Meier, W. K. Kellogg (California Inst. of Technology, Pasadena), and Roberto Terlevich [1980] 14 p refs

(Grants NsG-5384; NSF AST-78-21453)

(NASA-CR-163430) Avail: NTIS HC A02/MF A01 CSCL 03A

Three extragalactic regions of rapid star formation with red shifts great enough to separate the L alpha region from geocoronal L alpha were observed with the IUE satellite. Only the low metal abundance object had detectable L alpha emission. L alpha is therefore expected to be weak or absent in collapsed primeval galaxies. The detected object has a L alpha H beta identical to that of quasars. Author

N80-30243*# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany). Koenigstuhl.

LIQUID HELIUM COOLED INFRARED TELESCOPE FOR ASTRONOMICAL AND ATMOSPHERIC MEASUREMENTS ON BOARD SPACELAB Final Report

Dietrich Lemke, Gustave Klipping (Max-Planck-Gesellschaft, Berlin), and Norbert Roemisch (DFVLR, Cologne) Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1979 19 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-17) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 3.60

As a complement to the large infrared telescope on board Spacelab (LIRTS), a smaller liquid helium cooled infrared telescope for observation in the far infrared is scheduled for flight on the Spacelab D4 mission in 1983 for use in a combined study comprising both astrophysical and aeronomical measurements. The telescope is described as well as the cooling system which presents the possibility of studying fundamental aspects of helium 2 physics. Author (ESA)

N80-30244# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, (xi AND eta, USING A PRISM

ASTROLABE. PART 4: OBSERVATIONS IN THE NOERDLINGER RIES DURING 1970 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI UND ETA MIT DEM PRISMENASTROLABIUM. 4: BEOBACHTUNGEN IM NOERDLINGER RIES IM JAHR 1970]
Adolf Roedde 1979 86 p refs In GERMAN; ENGLISH summary
Original contains color illustrations
(Ser-B-237-PT-4; ISSN-0071-9196) Avail: NTIS HC A05/MF A01

Astronomic determinations of longitude and latitude, performed simultaneously using a Ni-2 astrolabe, at 12 stations on a meridian profile across the Noerdlinger Ries are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

N80-30245# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, xi AND eta, USING A PRISM ASTROLABE. PART 5D: OBSERVATIONS ALONG 48 DEG LATITUDE DURING 1974 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI UND ETA MIT DEM PRISMENASTROLABIUM. 5D: BEOBACHTUNGEN IM 48 BRIETENGRAD IM JAHR 1974]
Adolf Roedde 1979 117 p refs In GERMAN; ENGLISH summary
(Ser-B-238-Pt-5D; ISSN-0071-9196) Avail: NTIS HC A06/MF A01

Astronomic determinations of longitude and latitude performed simultaneously using a Ni-2 astrolabe at 17 stations on a geoid profile along 48 deg latitude are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

N80-30246# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, xi AND eta, USING A PRISM ASTROLABE. PART 5E: OBSERVATIONS ALONG 48 DEG LATITUDE DURING 1963 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI UND ETA MIT DEM PRISMENASTROLABIUM. 5E: BEOBACHTUNGEN IM 48 BREITENGRAD IM JAHRE 1963]
Adolf Roedde 1979 63 p refs In GERMAN; ENGLISH summary
(Ser-B-239-Pt-5E; ISSN-0071-9196) Avail: NTIS HC A04/MF A01

Astronomic determinations of longitude and latitude performed simultaneously using a Ni-2 astrolabe at 13 stations on a geoid profile along 48 deg latitude are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

N80-30247# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
SIMULTANEOUS DETERMINATION OF THE COMPONENTS OF VERTICAL DECLINATION, xi AND eta, USING A PRISM ASTROLABE. PART 5F: OBSERVATIONS ALONG 48 DEG LATITUDE DURING 1975 [SIMULTANBESTIMMUNGEN DER LOTABWEICHUNGSKOMPONENTEN XI AND ETA MIT DEM PRISMENASTROLABIUM. 5F: BEOBACHTUNGEN IM 48 BREITENGRAD IM JAHRE 1975]
Adolf Roedde 1979 86 p refs In GERMAN; ENGLISH summary
(Ser-B-240-Pt-5F; ISSN-0071-9196) Avail: NTIS HC A05/MF A01

Astronomic determinations of longitude and latitude performed simultaneously using a Ni-2 astrolabe at nine stations on a geoid profile along 48 deg latitude are reported. The declinations of the vertical for the star system RE 1950 were calculated using a computer program and are given in tabular form. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-30248# Florida Univ., Gainesville.
AN ANALYSIS OF THE ROSSITER EFFECT IN ALGOL-TYPE ECLIPSING BINARY SYSTEMS Ph.D. Thesis
Laurence William Twigg 1979 217 p
Avail: Univ. Microfilms Order No. 8016589

An analysis of the Rossiter effect is used in order to determine the rate of stellar equatorial rotational velocities for the primary components of 19 Algol type eclipsing binary systems. In addition, analyses of the associated light curves and determination of new absolute parameters were carried out for these systems. Further, the radii of possible ring structures existing around the primary components in several systems were determined. Finally, evidence is presented indicating that for several suspect systems no extra light is present at second and third contact, unlike the results of an analysis of Y Psc. It is suggested that the inclusion of rotation effects on the stellar figures removes the need for such extra light. Dissert. Abstr.

N80-30249 State Univ. of New York, Stony Brook.
ANISOTROPIC SUPERFLUIDITY IN NEUTRON STARS AND STRONG-COUPLING EFFECTS IN SUPERFLUID 3He Ph.D. Thesis
James Avery Sauls 1980 159 p
Avail: Univ. Microfilms Order No. 8017748

The minima of the general Ginzburg-Landau functional for 3P2 pairing was found. Estimates of the strong coupling effects in neutron matter indicates that the strong coupling functional remains in the same region of parameter space as the BCS functional. Studies of the effect of a magnetic field on the anisotropic neutron superfluid show that in a strong magnetic field the pairing state has an angle dependent energy gap with a mode along the field direction. Methods of homotopy theory are used to determine the topologically stable line defects allowed by 3P2 order parameters. The form of the order parameter in the core region observed implies that neutron vortices have a magnetic moment directed along the vortex line. Normal state transport coefficients and superfluid strong coupling effects in liquid helium 3 were determined by integrals quadratic in the quasiparticle scattering amplitude. With a parameterization of the potential scattering models for the scattering amplitude, all properties of interest can be calculated analytically. The model scattering amplitude can be fitted to any or all the measured quantities with minimum computational effort. Dissert. Abstr.

N80-30250 Rice Univ., Houston, Tex.
ISOTOPIC ANOMALIES FROM NUCLEAR PROCESSES IN STARS Ph.D. Thesis
Marlene Dziczkaniec 1980 181 p
Avail: Univ. Microfilms Order No. 8018048

Specific nucleosynthetic environments are examined as the sources for the anomalous xenon observed in meteorite samples. A simplified nuclear network is used to allow rapid estimation of isotopic abundance over a wide range of stellar conditions. In the zone of oxygen burning outside a stellar core that is in the silicon burning phase of energy generaton, photodisintegration of xenon seed isotopes is shown to be a potential source of an overabundance of the p-isotopes of xenon. The result Xe-124/Se-126 1 can be otained if theoretical calculations systematically overestimate photoalpha emission rates of certain p-isotopes of elements in the xenon region of the chart of the nuclides. Anomalies to the abundance of the heaviest xenon isotopes are shown to be a possible consequence of neuron capture reactions during explosive carbon burning in a supernova. Isotopic abundance signatures in the elements krypton, tellurium and osmium that are correlated with anomalous xenon are shown to be a plausible result of nuclear processing in the same environments that may produce anomalous xenon. The relative abundance of L-129 associated with anomalous xenon is also examined, and predictions for anomalies in other elements are given. Dissert. Abstr.

N80-30251# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
SUBMILLIMETER LINES OF INTERSTELLAR MOLECULES
V. D. Gromov 1979 16 p refs
(Pr-515) Copyright. Avail: NTIS HC A02

The calculated frequencies are given for submillimeter rotational lines of the molecules HCN, HNC, HCO(+), and N2H(+) with wavelengths of more than 250 microns as well as for lines of the molecules CH3OH, HDO, and HNCO with wavelengths of 330 to 375 microns. The intensity of the interstellar submillimeter line emission of the Ori A (KL) nebula is also estimated in the 350 micron atmospheric transparency window. Author (ESA)

N80-30252 Oklahoma Univ., Norman.
NON-LTE EFFECTS IN SUPERNOVA ENVELOPES Ph.D. Thesis
Andrew Neil Feldt 1980 89 p
Avail: Univ. Microfilms Order No. 8016927

The Sobolev method was applied to the statistical rate equations for multi-level representations of singly ionized silicon and neutral hydrogen for various models of supernova envelopes. The physical models are based on the power law models of Branch (1977). The electron temperature in the envelope is taken as isothermal or as decreasing outward in the envelope as derived for a gray, spherical atmosphere. Radiation is treated for two cases. In the dilute case, the radiation field is simply the dilute photospheric radiation except when the continuum becomes optically thick where it is replaced by the diffuse radiation field in the approximation given by Castor and Van Blerkom (1970). In the discontinuous opacity case, the size of the photosphere is allowed to extend indefinitely for frequencies greater than some transition frequency. Thus, some lines and continua are treated in the dilute case while others see only the local radiation. In all cases the resulting source functions and line optical depths are compared to those obtained by less detailed calculations with good agreement. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-30253 Rice Univ., Houston, Tex.
TWO MODELS FOR ISOTOPIC VARIATIONS IN THE LUNAR REGOLITH Ph.D. Thesis
James R. Ray 1980 103 p
Avail: Univ. Microfilms Order No. 8018083

Two independent models are presented which attempt to account for large, apparently secular, isotopic variations recorded in lunar samples. To explain the observed long-term increase of 15N/14N, the first model considers the consequences of a 'spike' contamination of the Sun's outer convective zone which material greatly enhanced in 14N. The second model takes note of observational evidence from the Apollo 16 site which indicates that even though TiO2-rich samples from other sites show a long-term increase of 3He/4He, TiO2-poor samples do not. Lunar atmospheric He is ultimately responsible for secular isotopic variations. In order for atmospheric He to have been an important source of trapped lunar gas, the ancient solar wind flux must have been about 100 times greater than now. The different He isotopic records of TiO2-rich and poor samples can be explained if ancient atmospheric He ions were implanted with larger energies than contemporary solar wind ions. Dissert. Abstr.

N80-30254 Rice Univ., Houston, Tex.
A FINITE-ELEMENT MODEL OF LUNAR THERMAL EVOLUTION Ph.D. Thesis
Soman Chacko 1980 167 p
Avail: Univ. Microfilms Order No. 8018040

An attempt is made to model the thermal history of a self gravitating moon. Since the Rayleigh number at the end of the accretionary stage is supercritical, thermal convection in the Moon is likely to have occurred as early as 4.6 billion years ago. A combination of the Stokes equation of viscous flow and the heat transfer equation is solved using the finite element method. The numerical code used is a modification of Gartling's NACHOS, a general purpose code for transient, two dimensional incompressible fluid flow problems. The effects of melting, viscous dissipation, and adiabatic gradient are included. The convection pattern is dominated by a L-2 mode and viscosity is the predominant factor in controlling the nature of the thermal evolution. Partial melting is observed very early in the Moon's history, which could be related to the formation of the lunar basalt maria. The present day lithospheric thickness of the model is about 600 km and core-mantle temperatures are close to 1600 K. Surface heat flux is 15.3 mW/sq m, higher than the steady state value by about 12 percent. Dissert. Abstr.

N80-30255 Academy of Sciences (USSR), Moscow. Inst. for Space Research.
VENERA 11 AND 12: SCIENTIFIC EXPERIMENTS
V. G. Istomin, L. V. Ksanfomaliti, V. I. Moroz, L. M. Mukhin, G. S. Narimanov, and V. G. Perminov 1979 33 p refs
(D-280) Copyright. Avail: NTIS HC A03

Studies made by the Venera 11 and 12 descenders as well as the characteristics of the onboard instruments are discussed. The payloads of both descenders were identical. These consist of a mass spectrometer for studying the minor components of the atmosphere, a gas spectrometer for studying the chemical composition of the atmosphere, and an optical spectrophotometer for studying adsorption and scattering of sunlight in the cloud layer and in the atmosphere of Venus. Also part of each payload are a superlong wave GROZA radioreceiver--spectroanalyzer for detecting lightning in the atmosphere, an X-ray fluorescent spectrometer for analyzing the aerosol content, a nephelometer for studying the microphysical properties of aerosol particles, and instruments for measuring temperature and pressure changes relative to spacecraft attitude. Author (ESA)

N80-30256 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THE POSSIBILITIES OF STUDYING THE INTERNAL STRUCTURE OF THE EARTH'S GROUP OF PLANETS WITH THE GEOPHYSICAL TECHNIQUES FROM SPACE VEHICLES
G. A. Skuridin, A. G. Ivanin, and I. N. Galkin 1979 42 p refs
(D-281) Copyright. Avail: NTIS HC A03

Space technology presently allows for the use of a variety of geophysical techniques in the study of the internal structure of planets; however, the validity of these techniques in constructing reliable quantitative models of planetary structure is not equivalent. Taking into account difficulties in delivering geophysical instruments to the planet surface, the aims (elucidating planetary evolution) and problems posed in obtaining appropriate data are assessed. Emphasis is placed on seismology as being most promising. Lunar seismic results are examined. Author (ESA)

N80-30257 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE CHEMICAL COMPOSITION OF THE VENUS TROPOSPHERE AND CLOUD LAYER. CONSIDERATION OF VENERA 11 AND 12 AS WELL AS PIONEER VENUS MEASUREMENTS
V. A. Krasnopolsky and V. A. Parshev 1979 24 p refs
(Pr-514) Copyright. Avail: NTIS HC A02

Data from chemical composition measurements made by Venera and Pioneer Venus probes are compared with the results of calculations of thermochemical equilibrium in the Venus lower atmosphere. The difficulties inherent in the assumption of the existence of considerable amounts of molecular oxygen are mentioned. The identification of aerosol substances in clouds using phase equilibrium methods is discussed. Some sulfur and chlorine compounds found in Venus clouds are considered. Author (ESA)

N80-30258 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
VENERA 9 AND 10: SPECTROSCOPY OF SCATTERED RADIATION IN THE CLOUD COVER OF THE VENUS

ATMOSPHERE
V. A. Krasnopolsky 1979 22 p refs
(Pr-523) Copyright. Avail: NTIS HC A02

Spectroscopic observations on the planet limb were used to determine the main characteristics of aerosols in the cloud cover of the Venus atmosphere. In the height range 70 to 100 km particle radii varie from 1 to 0.1 or 0.2 microns, particle number density is from 100 to 0.1/cu cm, while mass loading is from (10 to the minus 9) to (10 to the minus 15) g/cu cm. The sulfuric acid mixing ratio is found to be from (10 to the minus 6) to (5 X 10 to the minus 9). The eddy mixing coefficient is equal to 10,000 sq cm/sec at 70 to 75 km and increases to 1,000,000 or 10,000,00 sq cm/sec at 90 to 100 km. The spectroscopic thresholds for seven components at various heights are also shown. Author (ESA)

N80-30259# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE NATURE OF OBSTACLES TO SOLAR WIND NEAR VENUS AND MARS. ON THE PECULIARITIES OF SOLAR WIND INTERACTION WITH THE ATMOSPHERES OF THESE PLANETS
T. K. Breus and K. I. Gringauz 1979 32 p refs
(Pr-533) Copyright. Avail: NTIS HC A03

Recent data obtained by the Soviet Venera and Mars spacecraft is used to compare typical features of the regions of solar wind interaction with Venus and with Mars. Similarities and differences in the interaction are identified. Venus is seen as presenting a smaller obstacle to the solar wind than Mars as the Venus bow shock is closer to the planet. Analysis of experimental data indicates that the Venus ionosphere and its induced magnetic field are decisive in bow shock formation effecting solar wind flow around the planet, while for Mars it is the intrinsic field of the planet which decelerates the solar wind. Author (ESA)

N80-30260# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
LOW ENERGY ELECTRONS IN THE VENUS OPTICAL UMBRA DETECTED BY VENERA 9 AND 10. THE SOURCE OF THE NIGHT IONOSPHERE: COMPARISON WITH THE PIONEER VENUS SATELLITE MEASUREMENTS
K. I. Gringauz, M. I. Verigin, and T. K. Breus 1979 17 p refs
(Pr-534) Copyright. Avail: NTIS HC A02

Analyses of Venera 9 and 10 electron flux measurements in the Venus optical umbra are used to show that the detected flux rate is sufficient to ionize the neutral atmosphere of the planet and thus create its night ionosphere. These calculations are based on simultaneous measurements in nine cases from the Venera 9 and 10 spacecraft of the electron density profiles made at 140 km height by the radio occultation technique. Electron flux spectra are compared with Pioneer Venus quadrupole mass spectrometer data and a correlation is drawn taking into account the effect of oxygen atoms on the height variation of ionizing electrons. Author (ESA)

N80-30261*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HISTORY OF THE MASS OF MERCURY
R. A. Lyttleton 1 Aug. 1980 36 p refs
(Contract NAS7-100)
(NASA-CR-163438; JPL-Pub-80-44) Avail: NTIS HC A03/MF A01 CSCL 03B

A historical investigation reveals that Newcomb omitted to complete the calculation for the mass of mercury which would have given 8,405,291(-1), but instead arbitrarily adopted a value of 6,000,000(-1). This baseless figure 6000000(-1) became generally accepted and adopted in subsequent attempts to improve the mass. That only small changes have emerged is likely to be no more than a consequence of relying on a least squares process. Reduction of the Mercury mass to 9,000,000(-1) would alter theoretical angular positions of Venus by less than inherent observational errors, but the theoretical distances would be changed by amounts probably capable of detection by radar means. M.G.

N80-30262# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
THE HELIOS MICROMETEOROID EXPERIMENT: SOLAR PROBE HELIOS A AND B EXPERIMENT 10 Final Report
Eberhard Gruen, Hugo Fechtig, Peter Gammelin, Jochen Kissel, Siegfried Auer, Gunter Braun, Bernd-Klaus Dalman, Hagen Dietzel, and Hans-Joachim Hoffman Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1979 243 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-09) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 50,60

The micrometeoroid experiment on board Helios makes possible the in-situ detection of interplanetary dust particles. The experiment consists of two sensors which are inclined differently with respect to the equatorial plane of the spacecraft. It is based on the plasma production resulting from the impact of fast particles (V > or = 1 Km/sec) on a solid target. The instrument characteristics are discussed. Micrometeoroids are measured in the mass range from (10 to the -16) g to (10 to the -8)g and in the speed range from 2 km/sec to 50 km/sec. Additionally, the direction of impact is determined with an accuracy of + or - 60 deg. The particle charge is measured in the range from (10 to the - 14) to (10 to the -12) Coulomb. The ion composition of the impact plasma is mass analyzed with a time of flight spectrometer in the range 15 to 70 amu. The mass resolution is M/Delta M approximately 10. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-30263 Maryland Univ., College Park.
PLASMA PROPERTIES AND RADIATION SIGNATURES OF CURRENT DRIVEN ACTIVE REGION LOOPS ON THE SUN Ph.D. Thesis
Loukas Vlahos 1979 179 p
Avail: Univ. Microfilms Order No. 8017191

The average plasma density in the coronal part of a loop is higher than in its surroundings but the ratio of the plasma kinetic pressure to magnetic pressure is less than one. These loop-like magnetic field lines may act as the energy transport lines from the internal layers of the Sun's photosphere to the chromosphere and the corona where the energy is stored and suddenly released or slowly dissipated. The photospheric disturbances which are associated with steady currents along the potential magnetic field lines were studied in order to identify the radiation signatures of the current density and its profile as well as the size of the loop in which the current flows. Three basic phenomena in which the current supposedly plays an important role are examined: the sudden release of energy in small loop-like structures (flares); the heating of loops of different sizes by anomalous current dissipation; and the sudden erosion of large scale loops (coronal transients). It is concluded that (1) the current driven from the fluid motions in the photosphere can, under certain conditions, trigger the tearing mode instability in a finite volume at the top of a small loop which may result in a sudden local heating and a transient electron acceleration; (2) the heating of a loop by 'anomalous' dissipation of currents is not feasible if the currents are driven from the photosphere and (3) it appears that under certain conditions the current flowing along a very large loop can force a loop upwards. Dissert. Abstr.

N80-30264 Arizona Univ., Tucson.
LONG PERIOD SOLAR OSCILLATIONS: A SEISMOLOGICAL AND INTERCOMPARATIVE STUDY Ph.D. Thesis
Thomas Preston Caudell 1980 104 p
Avail: Univ. Microfilms Order No. 8017752

The subject of global solar oscillations is addressed. These oscillations are observed as fluctuations in the diameter of the Sun. A diameter is determined by a mathematical solar edge definition at the Santa Catalina Laboratory for Experimental Relativity by Astrometry (SCLERA) instrument. The oscillations have periods ranging from a few minutes to several hours and have amplitudes measured in millionths of a solar radius. These small amplitudes are observable only due to the unique properties of the edge definition. The properties of the observed solar

oscillations are determined from the data; their statistical significance and repeatability are then tested. The possibility of using the observed oscillations as a seismic tool for understanding the solar interior and its motions is explored.
Dissert. Abstr.

N80-30265 Catholic Univ. of America, Washington, D. C.
THE EXTREME ULTRAVIOLET STRUCTURES OF SOLAR ACTIVE REGIONS Ph.D. Thesis
Kenneth Paul Dere 1980 158 p
Avail: Univ. Microfilms Order No. 8017720

The extreme ultraviolet emissions from solar active regions are analyzed to determine their temperatures, densities, pressures, emission measures, flow velocities and structures. The accuracy and limitations of the diagnostic techniques were evaluated. It is found that the active region structures are well correlated with the inferred and observed magnetic fields and that the electron pressure of the plasma is essentially constant over a wide range of temperatures. Cool (10 to the 5th power K < or = T < or = 10 to the 6th power K) loop structures are shown to be composed of unresolved filaments. Static and steady flow one dimensional hydrodynamical models of active region loops were constructed and used to interpret the observations. Both models require a loop cross section that diverges with height. This was found by comparing the static model with observed emission measures and the steady flow model with the observed flow velocities. No local heating was found to be needed in the transition zone. Transition zone downflows in active regions indicate a mass loss from the overlying coronal structures for which there is no known supply. Dissert. Abstr.

N80-30266 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
DUMBBELL DISTRIBUTION OF SUPERTHERMAL SOLAR WIND ELECTRONS FROM PROGNOZ 7 OBSERVATIONS
V. V. Temny and O. L. Vaisberg 1979 17 p refs
(Pr-499) Copyright. Avail: NTIS HC A02

Results from plasma spectrometer on board the PROGNOZ 7 satellite show the strong angular anisotropy of superthermal solar wind electrons on the arrival of an interplanetary shock wave. During the event, axis of the dumbbell angular distribution of electrons was oriented parallel to the interplanetary magnetic field projection and onto the scanning plane of the narrow angle electron spectrometer. Maximum temperatures of an anisotropic component of about 1,000,000 K were recorded with the magnetic field line both along and antiparallel to the component. The steady state behavior of the anistropic electron component was observed for about 30 hours while the interplanetary magnetic field line was directed approximately perpendicular to the Sun. The arguments for an exospheric origin of the anisotropic component are discussed. Author (ESA)

N80-30267*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFLUENCE OF MAGNETIC PRESSURE ON STELLAR STRUCTURE: A MECHANISM FOR SOLAR VARIABILITY
Kenneth H. Schatten and Andrew S. Endal (Louisiana State Univ., Baton Rouge) [1980] 14 p refs
(NASA-TM-81129) Avail: NTIS HC A02/MF A01 CSCL 03B

A physical mechanism is proposed that couples the Sun's dynamo magnetic field to its gravitational potential energy. The mechanism involves the isotropic field pressure resulting in a lifting force on the convective envelope, thereby raising its potential energy. Decay of the field due to solar activity allows the envelop to subside and releases this energy, which can augment the otherwise steady solar luminosity. Equations are developed and applied to the Sun for several field configurations. The best estimate model suggests that uniform luminosity variations as large as 0.02% for half a sunspot cycle may occur. Brief temporal variations or the rotation of spatial structures could allow larger excursions in the energy released. M.G.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-30268 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
VARIATION OF EXTRAGALACTIC SOURCES IN THE dm RANGE. SCINTILLATIONS ON THE INTERSTELLAR STRUCTURE OF LOOPS, SPURS, AND RIDGES
N. Y. Shapirovskaja 1979 33 p refs
(Pr-504) Copyright. Avail: NTIS HC A03

Data on the variability of extragalactic sources in the dm range are interpreted in terms of a hypothesis of scintillations on the inhomogeneities of interstellar structures in the galaxy. The behavior of a scintillation index in the wide frequency band 0.325 to 2.7 GHz is explained by the theory of scintillations on the large irregularities in the weak focusing regime at the boundary of the strong focusing regime. A finite angular source size (due to scattering in the interstellar medium) and self absorption of an emitted scintillating component at the low frequency end of the observed band are taken into account. Author (ESA)

N80-30269 Academy of Sciences (USSR), Moscow. Inst. of Space Research.
SPHERICAL ACCRETION ONTO COMPACT X-RAY SOURCES WITH PREHEATING: NO THERMAL LIMIT FOR THE LUMINOSITY
G. S. Bisnovatyi-Kagan and S. I. Blinnikov (Moscow Univ.) 1979 21 p refs
(Pr-526) Copyright. Avail: NTIS HC A02

Numerical solutions for spherically symmetrical accretion were obtained for the case of optically thin flow with X-ray preheating. The asymptotes of the solutions were investigated. It is found that for any efficiency of the energy release, including that typical of accretion onto neutron stars, solutions exist for any luminosity below the Eddington limit. This proves that there is no thermal limit for accretion. Author (ESA)

99 GENERAL

N80-30270# Department of Defense, Washington, D. C.
THE FY 1981 DEPARTMENT OF DEFENSE PROGRAM FOR RESEARCH, DEVELOPMENT AND ACQUISITION, FEBRUARY 1980
1 Feb. 1980 319 p Presented at 96th Congr., Second Sess., Washington, D.C., Feb. 1980
(AD-A086014) Avail: NTIS HC A14/MF A01 CSCL 05/1

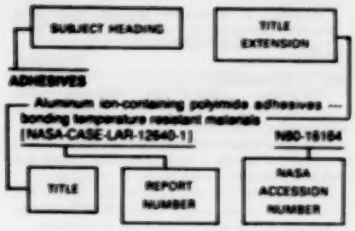
The challenge ahead is formidable. We are behind quantitatively in deployed equipment and are falling further behind because of disparities in equipment production rates. While we are still ahead in defense technology, we are in danger of losing that advantage because of massive Soviet spending in defense R D. But we also have some distinctive advantages: a superior technological base, a competitive industry with greater productivity, and allies with a substantial industrial capability. In order to meet the formidable challenge we face, our investment strategy must fully exploit these substantial advantages. Our overriding near term need is to get on with the modernization of our forces. Our technology is of little to our armed forces when it is not embodied in operational equipment. Most of our ground forces weapon systems now deployed; our main battle tank, our armored personnel carrier, our air defense gun missile, our attack helicopter were developed during the fifties and entered production in the sixties. As a consequence they simply do not incorporate current technology, and they provide maintenance and support problems created by their age. GRA

N80-30271# Department of Defense, Washington, D. C.
THE DEPARTMENT OF DEFENSE STATEMENT ON THE

SCIENCE AND TECHNOLOGY PROGRAM
Arden L. Bement, Jr. 5 Mar. 1980 66 p
(AD-A088015) Avail: NTIS HC A04/MF A01 CSCL 05/1

Requirements that must be addressed by technical solutions include: improved reliability (which is 'designed-in' and 'manufactured-in' not just 'tested-in'); life extension and durability of costly military hardware; conservation, substitution, and recycling technologies for critical materials; increased productivity and reduced manufacturing costs in our defense industrial base; the capability to substitute synthetic fuels for petroleum-based fuels; and improved human engineering to better match operational demands of new equipment to training and readiness levels. Advanced Technology Developments and the Manufacturing Technology Program provide great potential for meeting these requirements and accordingly deserve stronger emphasis in the future than is represented in our FY 1981 budget request. GRA

Typical Subject Index Listing



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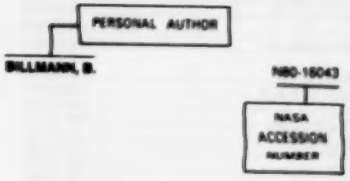

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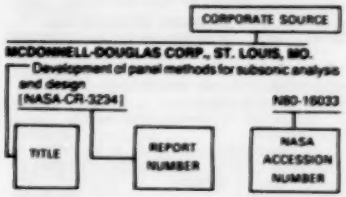

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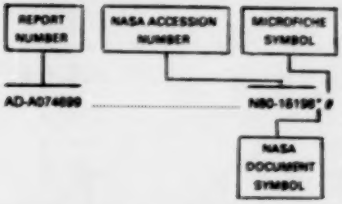

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NASA-CASE-GSC-12636-1 ..... N80-29705* #
NASA-CASE-LAR-11551-1 ..... N80-29834*
NASA-CASE-LAR-11745-1 ..... N80-29539*
NASA-CASE-LEW-13080-1 ..... N80-29496* #
NASA-CASE-MFS-23846 ..... N80-29704* #
NASA-CASE-MSC-18498-1 ..... N80-30050* #
NASA-CASE-MSC-18532-1 ..... N80-29543* #
NASA-CASE-NPO-13788-1 ..... N80-29835*
NASA-CASE-NPO-14406-1 ..... N80-29703*
NASA-CASE-NPO-14875-1 ..... N80-29584* #
NASA-CASE-NPO-15183 ..... N80-29843* #
NASA-CP-2133 ..... N80-29706* #
NASA-CP-2138-PT-1 ..... N80-29652* #
NASA-CP-2138-PT-2 ..... N80-29672* #
NASA-CP-2146 ..... N80-29300* #
NASA-CR-3030 ..... N80-29249* #
NASA-CR-3288 ..... N80-29251* #
NASA-CR-3294 ..... N80-29636* #
NASA-CR-3302 ..... N80-30155* #
NASA-CR-3307 ..... N80-30162* #
NASA-CR-3308 ..... N80-29964* #
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NASA-CR-135118 ..... N80-29299* #
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NASA-CR-159269 ..... N80-29746* #
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NASA-CR-159472 ..... N80-29297* #
NASA-CR-159517 ..... N80-29430* #
NASA-CR-159708 ..... N80-29960* #
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NASA-CR-159871 ..... N80-29852* #
NASA-CR-159874 ..... N80-29762* #
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NASA-CR-160633 ..... N80-29797* #
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NASA-CR-160666 ..... N80-29805* #
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NASA-CR-163442 ..... N80-29826* #
NASA-CR-163479 ..... N80-29900* #
NASA-CR-163943 ..... N80-29627* #
NASA-RP-1060 ..... N80-29245* #
NASA-SP-7037(124) N80-29243*
NASA-TM-8114 ..... N80-29412* #
NASA-TM-8116 ..... N80-30080* #
NASA-TM-78287 ..... N80-29414* #
NASA-TM-80210 ..... N80-29254* #
NASA-TM-80214 ..... N80-29431* #
NASA-TM-80631 ..... N80-29804* #
NASA-TM-80686 ..... N80-29806* #
NASA-TM-80716 ..... N80-29825* #
NASA-TM-80762 ..... N80-29255* #
NASA-TM-80788 ..... N80-29429* #
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NASA-TM-81035 ..... N80-29410* #
NASA-TM-81115 ..... N80-29413* #
NASA-TM-81122 ..... N80-30036* #
NASA-TM-81123 ..... N80-30230* #
NASA-TM-81125 ..... N80-29411* #
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NASA-TM-81129 ..... N80-30267* #
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NASA-TM-81219 ..... N80-29622* #
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NASA-TM-81559 ..... N80-29502* #
NASA-TM-81562 ..... N80-29333* #
NASA-TM-81568 ..... N80-29623* #
NASA-TM-81569 ..... N80-29624* #
NASA-TM-81574 ..... N80-30229* #
NASA-TM-81580 ..... N80-29433* #
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NASA-TM-81837 ..... N80-29463* #
NASA-TM-81842 ..... N80-29767* #
NASA-TM-81853 ..... N80-29766* #
NASA-TM-81854 ..... N80-29763* #
NASA-TM-81855 ..... N80-29768* #
NASA-TM-81864 ..... N80-29765* #
NASA-TM-81868 ..... N80-29764* #
NASA-TP-1667 ..... N80-29417* #
NASA-TP-1678 ..... N80-29369* #
NASA-TP-1685 ..... N80-29287* #
NASA-TP-1689 ..... N80-29244* #
NASA-TP-1704 ..... N80-29250* #
NASA-TP-1712 ..... N80-29911* #
NASA-TP-1714 ..... N80-29734* #
NAVOCEANCOMC/JTWG-TN-80-1 ..... N80-29968 #
NBS-GCR-80-199 ..... N80-30085 #
NBS-SP-500-58 ..... N80-30054 #
NBS-SP-500-59 ..... N80-30055 #
NBS-SP-544 ..... N80-29534 #
NBS-SP-566 ..... N80-29538 #
NBSIR-80-1976 ..... N80-30127 #
NQS-13 ..... N80-30128 #
NMAB-357 ..... N80-29041* #
NOAA-TM-ERL/GLERL-26 ..... N80-29675 #
NOAA-TR-NOS-82 ..... N80-30126 #
NOAA-TR-NWS-24 ..... N80-29974 #
NOAA-80032001 ..... N80-29975 #
NOAA-80032111 ..... N80-29974 #
NOAA-80032805 ..... N80-30126 #
NOAA-80040404-VOL-2 ..... N80-29952 #
NOAA-80040710 ..... N80-29834 #
NOAA-80041001 ..... N80-30139 #
NOAA-80041107 ..... N80-29830 #
NOAA-80042203 ..... N80-29977 #
NOAA-80042301 ..... N80-29982 #
NOAA-80042405 ..... N80-29976 #
NOAA/TM/EDIS-26 ..... N80-30139 #
NOO-SP-272 ..... N80-29955 #
NOO-SP-272-1 ..... N80-29956 #
NOSC/TR-530 ..... N80-29957 #
NPL-DNACS-24/80 ..... N80-29696 #
NPS55-80-008 ..... N80-29769 #
NPS55-80-012 ..... N80-30097 #
NRL-MR-4041 ..... N80-30135 #
NRL-MR-4151 ..... N80-30166 #
NRL-MR-4180 ..... N80-29941* #
NRL-MR-4198 ..... N80-29639 #
NRL-MR-4201 ..... N80-29943 #
NRL-MR-4207 ..... N80-30222 #
NRL-8369 ..... N80-29567 #
NRL-8386 ..... N80-29980 #
NSF/RA-790399 ..... N80-29535 #
NSF/RA-790400 ..... N80-29536 #
NSF/RA-800023 ..... N80-29474 #
NTIS/PS-78/0258 ..... N80-29632 #
NTIS/PS-78/0259 ..... N80-29633 #
NTIS/PS-78/0287 ..... N80-29495 #
NTIS/PS-78/0288 ..... N80-29494 #
NTIS/PS-78/0307 ..... N80-29604 #
NTIS/PS-78/0358 ..... N80-29753 #
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NTIS/PS-78/0582 ..... N80-29645 #
NTIS/PS-79/0295 ..... N80-29604 #
NTIS/PS-79/0327 ..... N80-29632 #
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NTIS/PS-79/0541 N80-29519 #
NTIS/PS-79/0588 N80-29844 #
NTIS/PS-79/0388 N80-30039 #
NTIS/PS-79/0801 N80-29646 #

NWC-TP-6161 N80-29293 #
NWC-TP-6185 N80-30193 #

ONR-CR212-261-1F N80-29292 #

ORNL-1310 N80-29868 #

ORNL/CSD-55 N80-30075 #

ORNL/ENG/INF-80/1 N80-30173 #

ORNL/SUB-79/13837/2 N80-30174 #

OSURF-784336 N80-29625 #

OTA-E-86A-VOL-2-PT-A-APP-1-4 N80-29520 #
OTA-E-86B-VOL-2-PT-B-APP-7-9 N80-29521 #
OTA-E-86C-VOL-2-PT-C-APP-10-14 N80-29522 #
OTA-E-86D-VOL-2-PT-D-APP-15-17 N80-29523 #

OWRT-A-051-NDAK(3) N80-29831 #
OWRT-A-087-KAN-1 N80-29926 #

P-278 N80-30236

PB80-169162 N80-29526 #
PB80-169469 N80-29527 #
PB80-169980 N80-30127 #
PB80-170004 N80-29829 #
PB80-170038 N80-29745 #
PB80-170491 N80-30230* #
PB80-170764 N80-29823 #
PB80-171226 N80-29525 #
PB80-173644 N80-30234 #
PB80-173776 N80-29916 #
PB80-173794 N80-29915 #
PB80-174220 N80-30233 #
PB80-174364 N80-29474 #
PB80-175102 N80-29924 #
PB80-175128 N80-29536 #
PB80-175185 N80-29524 #
PB80-175193 N80-30231 #
PB80-175201 N80-30232 #
PB80-175235 N80-29442 #
PB80-175268 N80-29989 #
PB80-175334 N80-29928 #
PB80-175367 N80-29931 #
PB80-175375 N80-29537 #
PB80-175599 N80-29921 #
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PB80-808455 N80-29483 #
PB80-808462 N80-29494 #
PB80-808477 N80-29495 #
PB80-809808 N80-30040* #
PB80-809816 N80-29604 #
PB80-809824 N80-29605 #
PB80-810419 N80-29702 #
PB80-810476 N80-29519 #
PB80-810542 N80-29753 #
PB80-810559 N80-29752 #
PB80-810567 N80-29632 #
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PB80-810641 N80-30039 #
PB80-810666 N80-29645 #
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PB80-810773 N80-29914* #

PIC-ELE-SC209/1 N80-29591* #

PMA-7-79 N80-29279 #

PR-2 N80-29262 #
PR-499 N80-30266
PR-504 N80-30268
PR-508 N80-30239
PR-514 N80-30257
PR-515 N80-30251 #
PR-523 N80-30258
PR-526 N80-30269
PR-533 N80-30259 #
PR-534 N80-30260 #

PRRL-79-CR-18 N80-30212 #
PRRL-80-CR-12 N80-29583 #

PSR-1013 N80-29561 #

PUB-LAW-96-316 N80-30226 #

QPR-2 N80-29584 #
QPR-7 N80-29472 #

QR-3 N80-29817* #

QTPR-1 N80-29896 #
QTPR-8 N80-29514 #
QTPR-9 N80-29513 #

R-857 N80-29586 #
R-862 N80-29487 #
R-868 N80-29571 #
R-872 N80-30210 #
R-1338-VOL-1 N80-29421 #
R-1338-VOL-2-APP N80-29422 #

RADC-TR-78-198 N80-29278 #
RADC-TR-79-247 N80-29551 #
RADC-TR-79-329 N80-29454 #
RADC-TR-79-330 N80-30214 #
RADC-TR-79-339 N80-29560 #
RADC-TR-79-356 N80-29558 #
RADC-TR-79-358 N80-29550 #
RADC-TR-80-1 N80-30212 #
RADC-TR-80-15 N80-29640 #
RADC-TR-80-18 N80-29563 #
RADC-TR-80-33-VOL-3 N80-30052 #
RADC-TR-80-78-VOL-1 N80-29421 #
RADC-TR-80-78-VOL-2 N80-29422 #
RADC-TR-80-82 N80-30180 #
RADC-TR-80-86 N80-30182 #

RAND/N-1260-AF N80-29404 #

RC-00221 N80-29801* #

REF-M79-53 N80-29982 #

REPT-1 N80-29535 #
REPT-2 N80-29536 #
REPT-77-FM-2-REV-5 N80-29411* #
REPT-79-10 N80-29535 #
REPT-79-11 N80-29536 #
REPT-80-FM-13 N80-30095* #
REPT-80-FM-33 N80-29410* #
REPT-80-R-695 N80-29415* #

REPT-80-5 N80-29739 #
REPT-1339-01-702174-REV N80-29585 #
REPT-6868-FR-VOL-1 N80-29917 #
REPT-6868-FR-VOL-2 N80-29918 #
REPT-6868-FR-VOL-3 N80-29919 #
REPT-6868-FR-VOL-4 N80-29920 #

RLO-2332-3 N80-29840 #

RR-80-1 N80-30136 #

RRC-79-ES-105A N80-29745 #

RSC-3337 N80-29813* #

RSSM/96-APP-D N80-30065* #
RSSM/97-APP-B N80-30063* #
RSSM/99-APP-A N80-30062* #
RSSM/100-APP-E N80-30066* #
RSSM/103-APP-C N80-30064* #
RSSM/104-APP-G N80-30068* #

R75AEG411 N80-29298* #
R77AEG229-VOL-2 N80-29299* #
R78AEG-574-VOL-2 N80-29297* #
R79AEG822 N80-29336 #
R80AEG345 N80-29439 #

SAM-TR-79-31-VOL-2 N80-30044 #
SAM-TR-79-34 N80-29268 #
SAM-TR-79-41 N80-30037 #

SAN-0113-040-T7 N80-29873 #
SAN-2207-T4 N80-29879 #

SAND-79-1374C N80-30106 #
SAND-79-2182 N80-29866 #
SAND-79-2371C N80-29869 #
SAND-79-7056 N80-29876 #
SAND-80-0354 N80-29841 #
SAND-80-0873C N80-29890 #

SAPR-5 N80-29902 #

SATR-1 N80-29828 #

SC5053.6FR N80-29290 #

SD-TR-80-17 N80-30178 #
SD-TR-80-22 N80-29420 #
SD-TR-80-26 N80-29423 #
SD-TR-80-34 N80-29588 #
SD-TR-80-37 N80-29585 #

SER-A-5 N80-29927 #

SER-B-237-PT-4 N80-30244 #
SER-B-238-PT-5D N80-30245 #
SER-B-239-PT-5E N80-30246 #
SER-B-240-PT-5F N80-30247 #

SERI/TP-83-350 N80-29882 #
SERI/TP-331-541 N80-29885 #
SERI/TP-334-478 N80-29884 #
SERI/TP-623-656 N80-29883 #
SERI/TP-641-619 N80-29892 #
SERI/TP-731-649 N80-29891 #

SERI/TR-311-493 N80-29874 #
SERI/TR-631-387 N80-29872 #
SERI/TR-09038-1 N80-29528 #

SF-27 N80-30211 #

SG-4253-1143 N80-29580 #

SMC-SOH-79-0001 N80-30085 #

SN-8331-F N80-29268 #

SR-LO-00440 N80-29820* #
SR-LO-00480 N80-29819* #

SR-PO-00454 N80-29814* #

SR-1 N80-29970 #
SR-2 N80-29944 #
SR-2 N80-29946 #
SR-91 N80-29982 #

SRC-CR-79-81 ..... N80-29558 #
SRD-80-056 ..... N80-30215 #
SRI-JSR-79-14 ..... N80-30033 #
SR80-R-4444-25 ..... N80-29335 #
SU-SOL-80-4 ..... N80-30104 #
SWT-80-1 ..... N80-29626 #
TARADCOM-TR-12468 ..... N80-29737 #
TH-78-E-88 ..... N80-30143 #
TH-78-E-89 ..... N80-30144 #
TH-78-E-92 ..... N80-30198 #
TID-28706 ..... N80-29833
TN-1980-8 ..... N80-29569 #
TN-1980-14 ..... N80-29405 #
TOP-2-2-605 ..... N80-29740 #
TPR-9 ..... N80-29699 #
TQPR-3 ..... N80-29673 #
TR-2 ..... N80-30213 #
TR-4 ..... N80-29441 #
TR-10 ..... N80-29497 #
TR-31 ..... N80-29587 #
TR-40 ..... N80-29531 #
TR-47 ..... N80-30099 #
TR-71 ..... N80-30101 #
TR-80-3-87 ..... N80-30218 #
TR-80-02 ..... N80-29777 #
TR-80-388200-1 ..... N80-30073 #
TR-177 ..... N80-30220 #
TR-845 ..... N80-29829 #
TR-890 ..... N80-30103 #
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